# WATER & SEWAGE WORKS

WATER SUPPLY • INDUSTRIAL WASTE TREATMENT • SEWAGE DISPOSAL

DECEMBER, 1951

Cedar Rapids Softening-Filtration Plant

*prevents wear on seats of*

# CHAPMAN

## *Tilting-Disc* CHECK VALVES

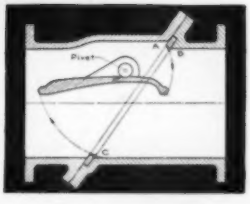
Here's the check valve with the balanced disc which is cushioned to a quick and quiet closure by the flow of gases or fluids as you can see in the cross-section at the right.

This smooth action prevents undue wear on seats, hinge pins and bearings . . . *and on your maintenance budget!* For there's no loosening of lines by vibration, no opened joints or ruptured pipes.

What's more, head losses are 65% to 80% less than conventional swing-type checks. Available in iron or steel in all standard pipe sizes. Get the complete story on this and other cost-cutting features of Chapman Tilting-Disc Check Valves, in the latest bulletin, No. 30. Send for your copy now.

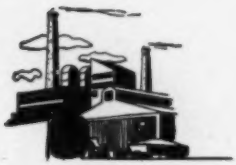
**THE CHAPMAN VALVE MFG. CO.**

INDIAN ORCHARD, MASSACHUSETTS



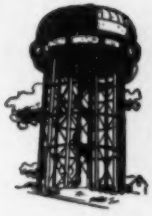

Cross-section of the Chapman Tilting-Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

**For greater yield in plant or field . . .**



**REPLACE WITH ONE OF THESE**

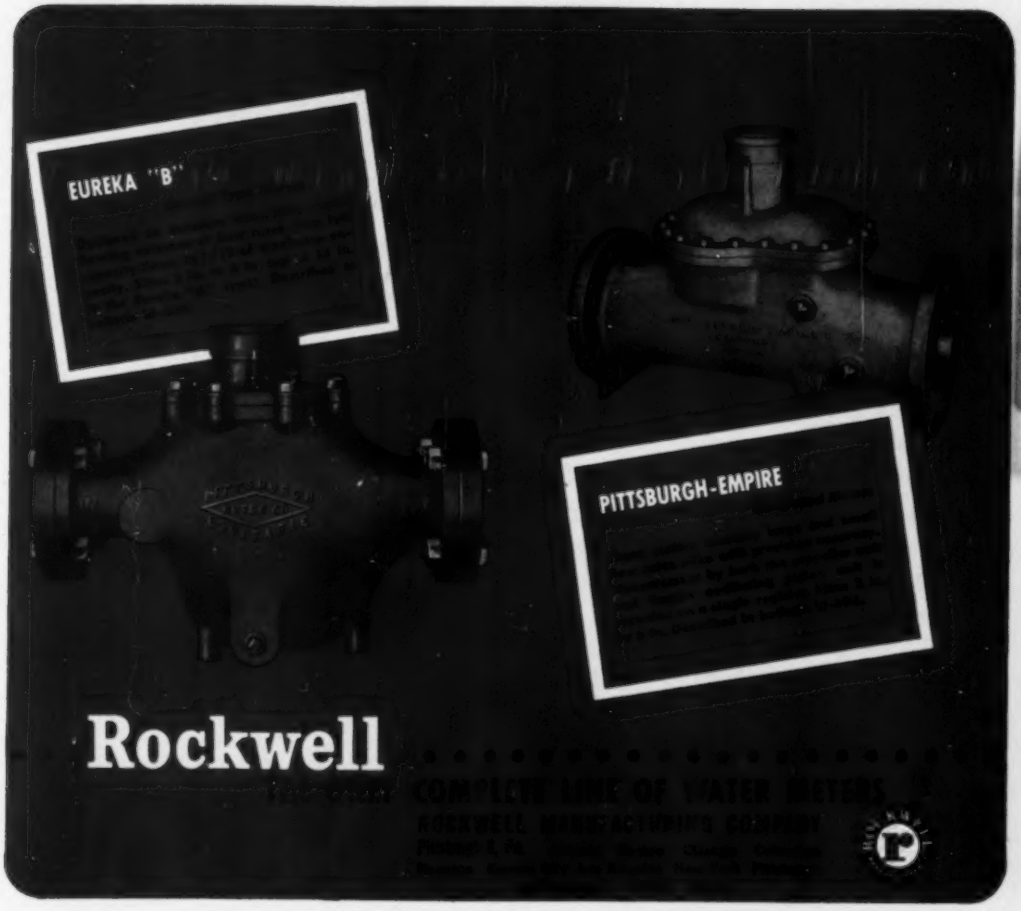
# BIG ROCKWELL METERS



Big water meters are a major investment.
Their true worth must be based on their revenue earning performance—their freedom from breakdowns and sticking—their economy to repair.

Cost-minded water works engineers specify big Rockwell meters because they will earn more revenue and yield more service per dollar invested. You'll find them simple, easy to repair, and constructed with typical Rockwell care from the finest materials obtainable.

*Immediate deliveries can be made from warehouse stocks in most areas.*



# INTRODUCING..

THE NEW WALLACE & TIERNAN

FLUORIDATOR

*Series A-635*

Special requirements of Fluoridation — primarily, extreme accuracy and dependability — were considered foremost in the design of W&T's new Series A-635 Fluoridator. A selection of models and a wide feed range make this feeder suitable for the application of sodium fluoride or sodium silicofluoride in most communities.

The basic feeder is volumetric with manual control, featuring the new two-directional feed screw for increased accuracy. Built-in scales can be supplied for periodic checking of the weight of chemical in the hopper.

The gravimetric, loss-of-weight, model is controlled from a unique scale beam housed in a dust-tight compartment. Registers indicate the rate of feed and the weight of chemical in the hopper at all times. Loss-of-weight recording is available with the gravimetric feeder to provide a permanent record of fluoridation.

WALLACE & TIERNAN COMPANY, INC.

S-67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# WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL
INDUSTRIAL WASTE TREATMENT


## COMING ARTICLES

"DEVELOPMENTS AND TRENDS IN WATER SUPPLY, SEWAGE AND INDUSTRIAL WASTE TREATMENT" will, as customary, be reviewed in our January and February issues. Water Supply Developments will be reviewed by A. E. Berry, Pres., AWWA. Sewage and Industrial Waste Treatment by Earnest Boyce, Pres., F.S.&I.W.A. . . . "A NEW COAGULATION AID" will be introduced to the field by Steeper and Dickerson of Hercules Powder Co. and Kemmer and Houser of Cochrane Corp. . . . "EXPERIENCES IN MAIN CUTTING" are set forth by Dan Anglin, Distr. Supt., Chicago Water Dept. . . . "DEEP WELL MAINTENANCE" is discussed by J. B. Murphy of Am. Water Wks. Service Co. . . . Albert Ullrich completes his series of articles on "WATER TREATING EXPERIENCES"


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**For maximum economy in non-pressure sewer lines . . .**

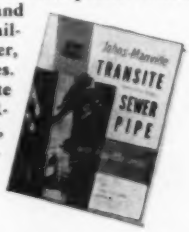
# Specify TRANSITE SEWER PIPE with new RING-TITE JOINTS

Whether you plan to extend existing sewer lines, or build a complete new system, you'll want to check into the money-saving possibilities offered by Transite Sewer Pipe with its new Ring-Tite Couplings.

Without the need for hot jointing compounds, this factory-made coupling is quickly and easily assembled to make a tight joint that stays tight in service. This, plus the fact that Transite's long 13-foot lengths mean fewer joints in the line, cuts infiltration to a minimum. Thus, the load on the disposal plant is cut down, treatment costs reduced, and plant capacity conserved for future needs. And, in the planning of new systems, smaller treatment plants and smaller diameter sewers may be considered . . . with resultant savings in money, time and labor!

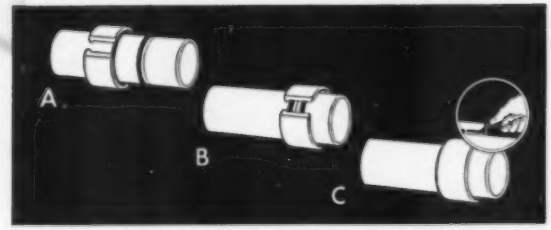
Important installation savings are possible, too, with Transite Sewer Pipe. Its relatively light-weight, long 13-foot lengths, and easy-to-assemble Ring-Tite Couplings speed completion of the line. It can be readily cut on the job for closures and branch connections. And its high flow capacity (Manning's n=.010) often permits flatter grades and shallower trenches with savings in excavation, sheeting, etc.

Transite Sewer Pipe is made of asbestos, cement and silica by a special Johns-Manville process which develops maximum strength and corrosion-resistance. It is available in sizes to 36" in diameter, for non-pressure sewer lines. For further information, write for your copy of folder TR-103A. Address Johns-Manville, Box 290, New York 16, N. Y.




Transite is a registered Johns-Manville trade mark

**HERE'S HOW THE RING-TITE JOINT WORKS:**




(a) Start of assembly. Two rubber rings and a Transite sleeve (cut away to show position of rings) are placed on one of the two pipe ends to be joined; (b) Final position. Sleeve centered over both pipe ends, with the rubber rings tightly compressed between sleeve and pipe; (c) Checking joint for proper assembly. This is done with a simple gauge immediately after the joint is made . . . *before backfilling.*

JM PRODUCTS

**Johns-Manville TRANSITE SEWER PIPE**

**BECKMAN**—*the leading name in pH—presents another important advancement in instrumentation*

# *Announcing* The BECKMAN MODEL N pH METER

**Completely Portable!**

**Extremely Compact!**

**. . . and Really Rugged!**

In the constantly expanding field of pH, there is wide demand for a *completely portable* battery-operated pH instrument that is low in price, light in weight, compact in size, and amply rugged to be used anywhere—in the orchard, in the oilfields, in textile mills, plating shops, mining and mill operations, food processing plants, laboratories . . . *anywhere*, without dependence upon outside power circuits.

The newly developed Beckman Model N pH Meter not only meets all these requirements, but also many more. Here are the highlights. Check them over. *Never before have unique advantages like these been combined into a single pH instrument!*

**OPERATING SIMPLICITY AND ACCURACY . . .**

- Accuracy to better than 0.05 pH.
- Low operating cost—less than 2c per hour.
- Built-in temperature compensation—0° to 100° C.
- Fast warm-up—less than 10 seconds.
- "Check Pointer" eliminates need for frequent buffer standardization.
- Batteries are easily checked with the regular panel controls—no need to disassemble the instrument. Clip-mounting of batteries eliminates need for soldering or wiring.

**NEW COMPACTNESS AND RUGGEDNESS . . .**

- All-metal case—cast aluminum with baked enamel finish to resist wear and corrosion.
- Splash-proof design—fully desiccated internally.
- Shock-proof—each tube is individually shock-mounted.
- Light weight—less than 8 lbs., complete.
- Small, compact—only 4" x 6" x 9½" overall.
- Equipped with the new Beckman Red Label Glass Electrode—virtually unbreakable, covers almost the entire pH range, usable from freezing to boiling.
- By far the most rugged overall construction of any pH meter.

*GET ALL THE FACTS on this newest Beckman advancement in pH by contacting your nearest authorized Beckman instrument dealer. Or write direct!*

BECKMAN INSTRUMENTS

SOUTH PASADENA 20 CALIFORNIA

Factory Service Branches: Chicago — New York — Los Angeles

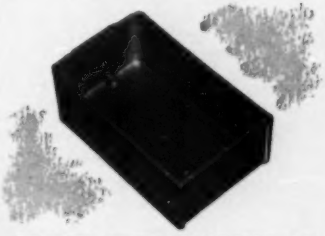
Beckman Instruments include: pH Meters and Electrodes — Spectrophotometers — Automatic Titrators — Radioactivity Meters — and Special Instruments

*NEW* **CONVENIENCE SIMPLICITY RUGGEDNESS**

**make the Beckman Model N a noteworthy advancement. The following features are typical . . .**

**ELECTRODE SUPPORT ROTATES** alongside case for maximum convenience in carrying. Instrument can be used in either horizontal position (shown at left) or vertical position (above)—whichever is handier.

**CONVENIENT CONTROLS** not only centralize all operating functions, but also permit checking amplifier circuits and battery condition without opening case or disturbing battery connections.



**RUGGED, COMPACT DESIGN** withstands rough field and plant service with negligible maintenance. Solid cast-aluminum case is strong, yet light in weight. Beckman Glass Electrode is virtually unbreakable!

**There are many other important features designed into the Model N. Be sure to get the *complete* story on this new Beckman development!**

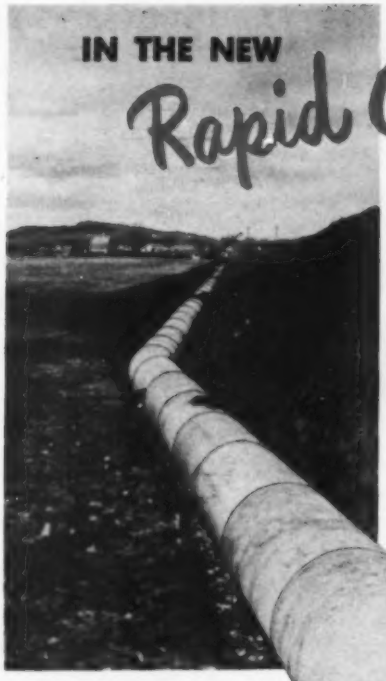
IN THE NEW

# Rapid City Sewer Line

## NO WATER LEAKS
## NO SEWAGE SEEPS

Through

# TYLOX *flexible rubber* JOINTS



Speed was the keynote — tight joints a "must" — on the new sewer line for Rapid City, S. D. And, both were achieved with TYLOX, the easily installed flexible rubber joint that makes lines leakproof for life!

By combining 6' lengths of reinforced concrete pipe with TYLOX gaskets, the contractors got permanently tight joints in jig time — and, at a "savings of many thousands of dollars to the city." Almost five miles of pipe, ranging from 18" bore up to 33" bore, were laid quickly and easily, despite a partially "wet ditch" that resulted from the grade line being below ground water level.

Best of all, the TYLOX gaskets — snapped on the pipe at the job site — assure a permanently tight line. No water can get in — no sewage can get out. The engineers can be certain they'll be treating sewage — not infiltrated water—at their disposal plant.

Why don't you be sure of no leakage and no infiltration, on your next pipeline project by using the right joint, the tight joint — the TYLOX joint?

## Thumbnail Facts about Rapid City's Main Trunk Line Sanitary Sewer

**City Manager: H. H. Babcock**
**City Engineer: Claude Bangs** **Consulting Engineer: Julian Steven**

**PIPE:** "Cretex" reinforced concrete pipe (ASTM—C75-41) in 6' lengths. Supplied by South Dakota Concrete Products Co., Watertown, S. D.

**Project No. 1:** 4500 lineal feet — 33" bore, T and G
800 lineal feet — 24" bore, T and G
800 lineal feet — 18" bore, T and G

**Project No. 2:** 6094 lineal feet — 33" bore, T and G
473 lineal feet — 30" bore, T and G
1017 lineal feet — 27" bore, T and G
4696 lineal feet — 24" bore, T and G
3301 lineal feet — 21" bore, T and G
1496 lineal feet — 18" bore, T and G

**CONTRACTORS:**
**Project No. 1:** Trowbridge-Oehring Construction Co., Columbus, Nebraska
**Project No. 2:** The Northwestern Engineering Co., Rapid City, S. D. and Denver, Colorado

**Making Joints with TYLOX RUBBER GASKETS**
**Is as simple as A B C**

Cement tongue and snap on Tylox gasket.

Lubricate sliding surfaces with Tylox Cement.

Shove the pipe home.

1696

**"THE ONLY PERMANENTLY TIGHT LINES ARE LAID WITH RUBBER JOINTS"**

# IMPROVED BACK-CLEANED SCREENS

OVER 10 YEARS PROVEN PERFORMANCE

Jeffrey pioneered in the development of the Back-cleaned Screen—has over ten years of experience in the design and building of this type of mechanization.

It is available in either inclined or vertical position—is highly recommended for all difficult screening problems, whether the plant is small or large. It is fool-proof. Dozens of installations prove its dependability and low maintenance.

Above—rear view of the Fine Screens (upper left) in the 26th Ward Plant showing Jeffrey Belt Feeder and Screening Grinder.

Many plants—both water, sewage and industrial—are being served by Jeffrey equipment. Names furnished upon request.

Two of four fine Screens installed in the 26th Ward Sewage Treatment Works, New York City. Right—one of four coarse heavy duty Screens at the same plant.

Also:

SLUDGE COLLECTORS
SLUDGE ELEVATORS
FLOCTROLS
GRIT WASHERS
GRIT COLLECTORS
BAR SCREENS
RAPID MIXERS
GRINDERS
CHEMICAL FEEDERS
CHAINS

Send for Catalog No. 833

THE JEFFREY MANUFACTURING COMPANY
ESTABLISHED 1877
Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

# A "Grand National" Winner... like Cast Iron Pipe...has

The Grand National Steeplechase, over a course of about 4½ miles with 30 jumps, is a rugged test of the *stamina* of a horse. Likewise, the test of time proves the *stamina* of cast iron pipe. For example, in more than 30 of the older American cities, cast iron water and gas mains are now in their second century of service. These sturdy mains are meeting changed conditions undreamed-of 100 years ago—in street traffic and in construction aboveground and underground. The resultant traffic shock and beam-stresses, cast iron pipe has taken in its stride, because of its shock-strength, beam-strength and crushing-strength.

*No pipe, deficient in any of these strength-factors of long life, should ever be laid in paved streets of cities, towns and villages.*

**CAST IRON PIPE**

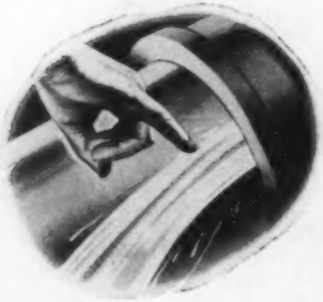
# STAMINA!*

* First run in England 112 years ago, the Grand National Steeplechase, over the famous Aintree course of 4 miles, 856 yards, was won in the record time of 9.20-2/5 by Golden Miller in 1934.

CAST IRON

CAST IRON PIPE RESEARCH ASSOCIATION; THOS. F. WOLFE, MANAGING DIRECTOR, 122 SO. MICHIGAN AVE., CHICAGO 3.

## SERVES FOR CENTURIES



A hole in a joint no larger than the end of your little finger will, under 65 psi pressure, discharge more than 80,000 gpd.

# Fix it once...

# Fix it for good

"Small" leaks cost you so much in gallonage . . . and repeated repairs cost you so much in dollars and cents . . . that the only practical repair is one that's *permanent.*

A permanent repair is certain every time when you put on a Dresser Bell-Joint Clamp. Clamping seals the joint with resilient rubber compound—provides a flexible repair to guard against future pipe movement, vibration and stresses which cause recalked joints to leak again and again.

It's standard practice to clamp all cast-iron bell and spigot joints near railroad tracks, on bridge lines, in unstable soil. Why not then make sure *every* repair lasts—why not "Fix it once—Fix it for good" the first time you uncover a leaking joint?

The Dresser Style 60 is adjustable to fit standard pipe, classes A thru E, and most off-size pipe. Sizes 3" to 60". Write today for descriptive literature and prices.

## DRESSER
### BELL-JOINT CLAMPS

Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pa. (One of the Dresser Industries). Warehouses: 1121 Rothwell St., Houston, Texas; 101 S. Bayshore Highway, South San Francisco, Calif.—Sales Offices: New York, Philadelphia, Chicago, Houston, South San Francisco. In Canada: 629 Adelaide St., W., Toronto.

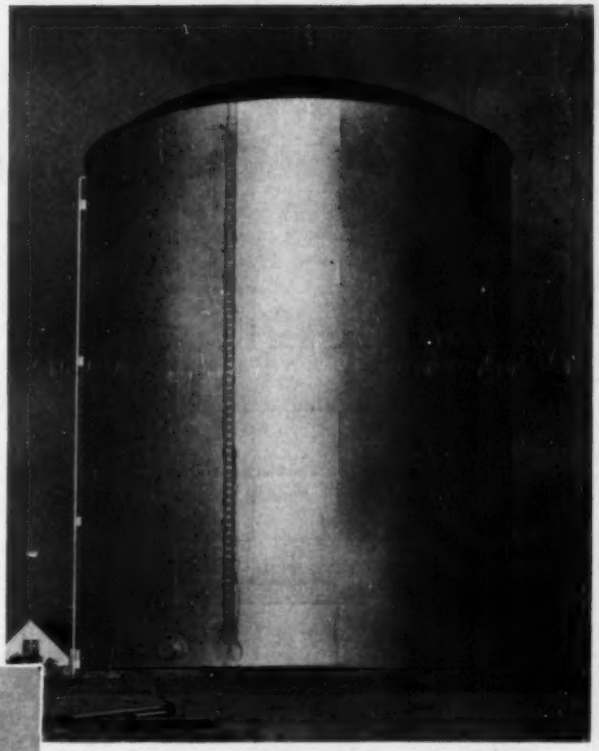
# LASTING PROTECTION AGAINST MUNICIPAL WATER SHORTAGES

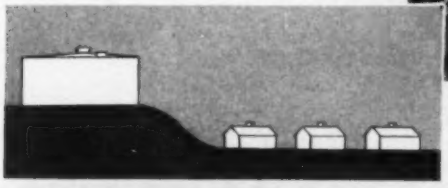
THE success of a municipal water system is measured by its performance under all conditions. Day in—day out, there must be enough water to satisfy every consumer. That's why Elk City, Oklahoma, recently installed a 500,000-gallon reservoir and a 1,500,000-gallon standpipe to supplement 850,000 gallons of elevated storage.

Elk City obtains its water from wells 18 miles away. Should anything happen to the long transmission main, the results could be quite serious. The required fire flow would not be available—and the city's health might be impaired.

With these two new Horton standpipes boosting the existing storage capacity—there is, however, a sufficient quantity of water to supply immediate needs of Elk City's 8,000 people until regular service is resumed. And there will be for many years—because the standpipe is of long-lasting welded steel plate construction.

Horton reservoirs and standpipes are built in capacities up to 10,000,000 gallons. Horton elevated water tanks are built in capacities from 5,000 to 3,000,000 gallons. Write us for complete details.





*The new 1,500,000-gallon standpipe (shown above) is 60 ft. in diam. by 72 ft. high and the new 500,000-gallon reservoir is 52 ft. in diam. by 32 ft. high. When steel reservoirs are located on a natural elevation, as shown at the left, they provide gravity pressure in water distribution mains.*

**HORTON**
WELDED STEEL
STORAGE TANKS

**CHICAGO BRIDGE & IRON COMPANY**
Plants in Birmingham, Chicago, Salt Lake City, and Greenville, Pa.

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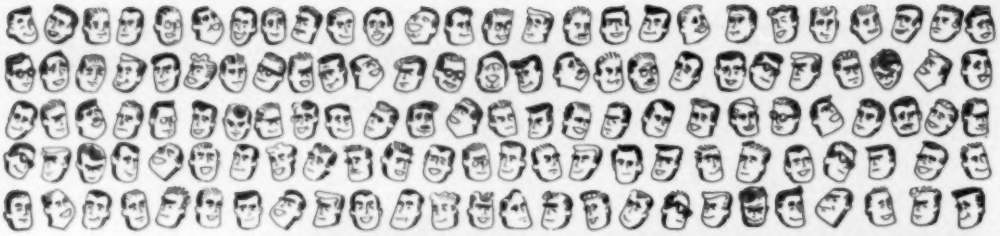
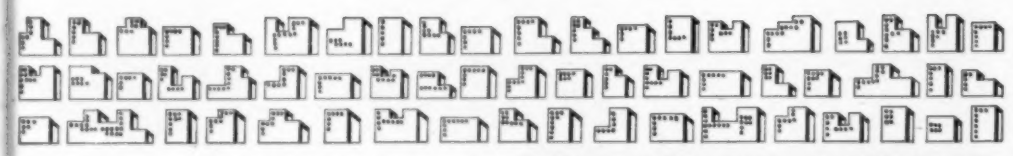
|---|---|---|---|
| Atlanta 3 | 2181 Healey Building | Los Angeles 17 | 1555 General Petroleum Building |
| Birmingham 1 | 1586 North Fiftieth Street | New York 6 | 3390-165 Broadway Building |
| Boston 10 | 1048—201 Devonshire Street | Philadelphia 3 | 1644—1700 Walnut Street Building |
| Chicago 4 | 2198 McCormick Building | Salt Lake City 4 | 868 West 17th South Street |
| Cleveland 15 | 2262 Guildhall Building | San Francisco 4 | 1583—200 Bush Street |
| Detroit 26 | 1551 Lafayette Building | Seattle 1 | 1380 Henry Building |
| Havana | 402 Abreu Building | Tulsa 3 | 1646 Hunt Building |
| Houston 2 | 2115 C & I Life Building | Washington 6, D.C. | 1109 Cafritz Building |



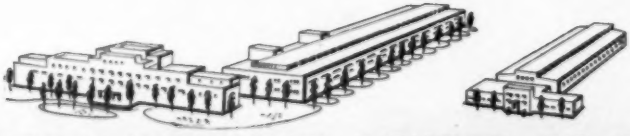
**257 FIELD REPRESENTATIVES**

**48 INSTALLATION INSTRUCTORS**



**58 SALES OFFICES**

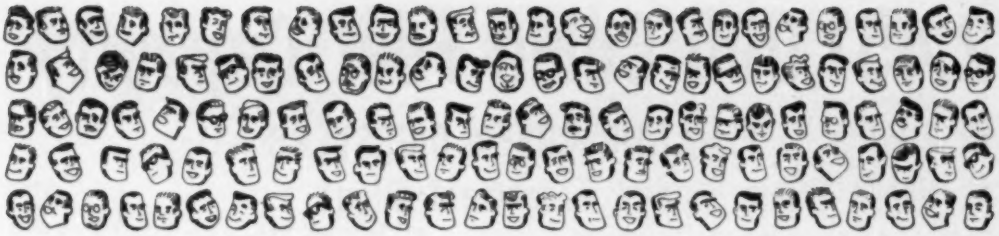
**5 MANUFACTURING LOCATIONS**



**THE LARGEST RESEARCH CENTER OF ITS KIND**

JOHNS-MANVILLE JM PRODUCTS

**Johns-Manville**



# *At your service—*

## . . . a complete, nationwide TRANSITE PIPE ORGANIZATION

Here is an organization which, over the past many years, has helped to bring a better, a more efficient and a more economical means of water transportation to many hundreds of American cities and towns.

Its facilities include more than 250 field representatives with headquarters in 58 cities. It also comprises a staff of competent installation instructors who explain recommended installation practices to pipe-laying crews. This Johns-Manville service is an important factor in helping to assure the installation economies as well as the long-term *overall* economies that go with Transite Pressure Pipe.

Behind this field organization are the modern production methods which assure the high quality of the finished product. These begin with careful selection of raw materials and are continued through the special processing operations to the final tests which each individual length of pipe must undergo before shipment is made. Five conveniently located plants now serve Transite Pipe users from coast to coast.

And back of all this is engineering—and research. For without them, the plus values that have been built into Transite Pipe would not have been possible. Today, in the new J-M Research Center, the engineer and the technician continue to find new answers to old problems. Their work is an indispensable part of the complete Transite Pipe service which Johns-Manville offers the water works industry. For further information, write Johns-Manville, Box 290, New York 16, N. Y.

*TRANSITE is a Johns-Manville registered trade mark

**TRANSITE ASBESTOS—CEMENT PRESSURE PIPE**

**FOR BETTER WATER SERVICE**

# 2,451,000 Cubic Feet Capacity

## IN 10 P.F.T. FLOATING COVER DIGESTERS at North Point Sludge Treatment Plant,

SAN FRANCISCO, CALIFORNIA

A RECENT addition to the long list of P.F.T. Floating Cover Digester installations is San Francisco's North Point Sludge Treatment Plant. Here, ten digesters are equipped with soundly designed, ruggedly constructed P.F.T. Floating Covers, each 100' in dia. "Controlled Digestion" facilities, including full flexibility of piping arrangement, external heating, volatile acids and ammonia nitrogen control, assure dependable, efficient digester operation. These digesters handle all of the sewage sludge for a population of 1,169,000.

There are two batteries of five digesters with a control building for each group, housing a total of eight P.F.T. sludge gas fired No. 1500 Digester Heaters and Heat Exchangers. These heaters are equipped with complete automatic controls to provide constant digester temperatures and heating of the control buildings. Total heater output capacity is 12,000,000 B.t.u./Hr. Other P.F.T. equipment at this plant includes spirally guided gas control holder lift for a 55' 6" dia. tank, floating cover position indicators, and a full complement of P.F.T. Gas Safety Equipment.

Sludge is pumped from the North Point Sewage Treatment Plant, over six miles away as well as from the Southeast Treatment Works, close by. The digested sludge from these ten digesters and from the Richmond-Sunset Treatment Plant is further processed by vacuum filtration and heat drying to provide a valuable supply of fertilizer for California growers. The engineering offices of Clyde C. Kennedy, San Francisco, were consulting engineers.

P.F.T.

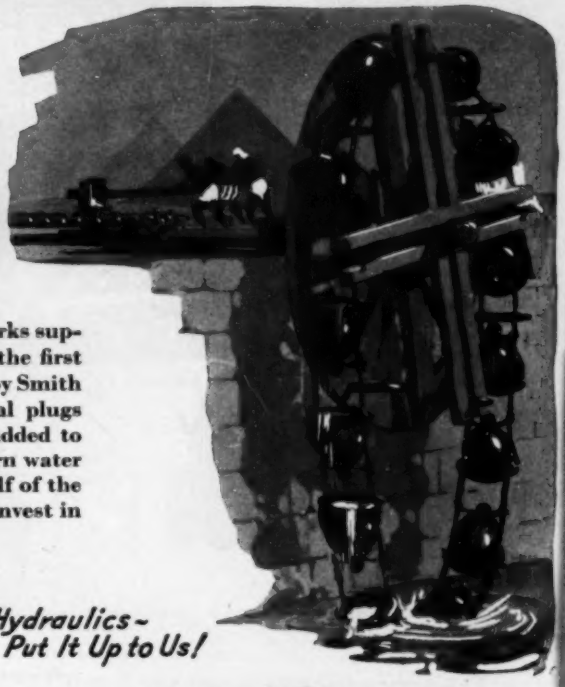
**PACIFIC FLUSH TANK CO.**

*Waste Treatment Equipment Exclusively Since 1893*

4241 RAVENSWOOD AVE. CHICAGO 13, ILLINOIS

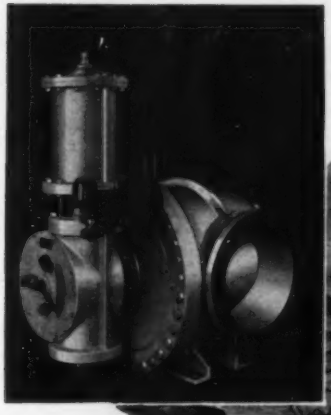
NEW YORK • LOS ANGELES • SAN FRANCISCO • CHARLOTTE, N. C. • JACKSONVILLE • DENVER

# *Modern* WATERWORKS *possible with* Rotovalves *by* SMITH



**MOVING ever onward, the huge water works supply systems of today have evolved from the first crude inventions of antiquity! Rotovalves by Smith with their full circular openings, conical plugs and electrically welded seat rings have added to the efficiency and reliability of the modern water works and sewage systems. Assure yourself of the utmost return on your Valve Dollar and invest in Rotovalves. Write for our bulletin.**

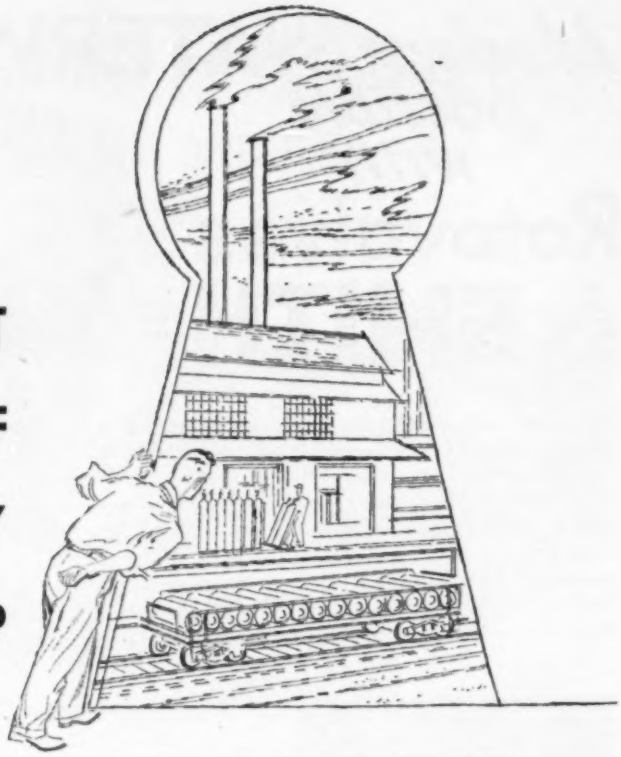
*If It's Hydraulics~ Put It Up to Us!*



## S. MORGAN SMITH Co.

YORK. PENNA. U.S.A.

*Chemicals you live by*



# WHAT KIND OF CURIOSITY HAVE YOU?

We assume you use chlorine and therefore are interested in the correct shipping, handling, storing and safety measures:

But would you like to see the Enthalpy-Temperature Diagram for Chlorine?

Or would you rather have a list of safety precautions in case your chlorine container springs a leak?

Want to know the boiling point of liquid chlorine or would you find ICC Regulations more helpful in your type of work?

**Whatever You Want to Know About Chlorine**

The Chlorine Handbook, published by DIAMOND Alkali, contains just about everything you could want to know about chlorine. The first half of the book is filled with general information, the second with technical data. DIAMOND, caught in the national shortage of many things, offers this Chlorine Handbook FREE, as a gesture of good will and in the genuine hope that it may help chlorine users to get as much as possible out of the chlorine they do receive.

**WRITE FOR YOUR FREE COPY TODAY**

**DIAMOND ALKALI COMPANY, CLEVELAND 14, OHIO**

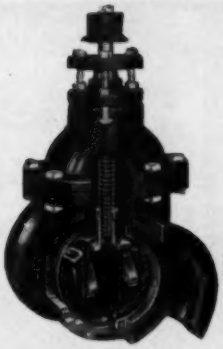
DIAMOND ALKALI CHEMICALS

# IOWA products

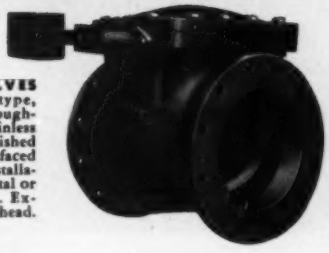
## meet your most exacting specification

Superiority of Design, Workmanship, and Materials Assures Efficient Trouble Free Operation . . .

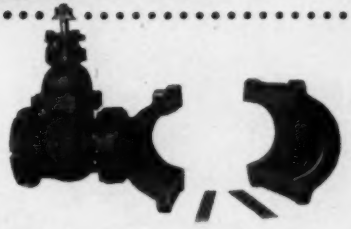
*In every job*



**IOWA GATE VALVES**—Simple, rugged construction, fully bronze mounted. Parallel seat, double disc type with independent solid bronze wedges and stem nut. Trouble free service assured.

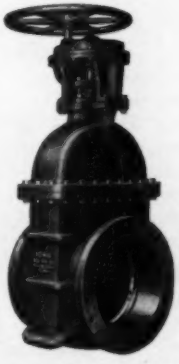


**IOWA CHECK VALVES**—Balanced swing type, bronze trimmed throughout. Equipped with stainless steel hinge pin. Furnished with rubber or leather faced disc if desired. For installation in either horizontal or vertical pipe lines. Extremely low loss of head.



**IOWA TAPPING SLEEVES and VALVES**—Sturdily built, easy to assemble and center on pipe. All bolted type with lead strips for tight sleeve connections. Extra long body sleeves with heavy flanges amply protect the cut. All sizes available.

**IOWA FIRE HYDRANTS**—Latest Corey type conforming to AWWA specifications. Will not geyser when standpipe is broken. Unique design provides unrestricted water flow with extreme low loss of head.



**IOWA SQUARE BOTTOM VALVES**—Specially designed for throttling service in filter wash and pump discharge lines. Square bottom features can be built into gate valves of any pressure ratings.

**IOWA HYDRAULIC VALVES**—Superiority of design matched with sturdy construction meets severe, continuous filter service requirements. Available with either iron, brass lined or brass tubing cylinders.

**IOWA SLUICE GATES**—Heavy cast iron construction, fully bronze mounted. Provided with solid bronze adjustable wedges. Suitable for seating and unseating pressures. Wide range of sizes.

*Write today for descriptive literature.*

**IOWA** VALVE COMPANY

**201-299 N. Talman Ave., Chicago 80, Ill.** • *A Subsidiary of James B. Clow & Sons*

# Rochester selects ALOXITE underdrains for new filtration plant

Information Courtesy Rochester Dept. of Public Works

Photo by Fairchild Aerial Surveys, Inc.

Rochester, New York, is supplementing its upland water supply by bringing in water from Lake Ontario. In connection with this project, it joins the growing list of cities that are installing ALOXITE aluminum oxide plates as underdrains for rapid-sand filters.

The Lake Ontario water, being somewhat turbid at certain seasons, has required construction of a new filter plant. Initially this new plant will have sufficient capacity to handle 36 millions of gallons per day. There are 12 rapid-sand filters, each consisting of two beds roughly 31 feet by 18 feet, and each having a capacity of 3 mgd. The bottoms are constructed of ALOXITE plates exclusively—supplied by The Carborundum Company. These underdrains will be covered by 24 inches of specially graded sand, with plans calling for 144 surface washers and a wash-water capacity of 8,500 gallons per minute.

Rochester is to be congratulated on its new plant—and upon the speed with which it was constructed. Our contribution—the porous plate underdrains—will go a long way toward keeping the city happy with low operating and maintenance costs.

Rochester's new supplementary water system is being installed under the direction of Mr. Edward F. Nier, Commissioner of Public Works, and Mr. Kenneth J. Knapp, City Engineer.

**May we send you our new booklet, "Porous Media for Filtration and Diffusion"? Its 56 pages are crammed with useful data. No obligation, of course.**

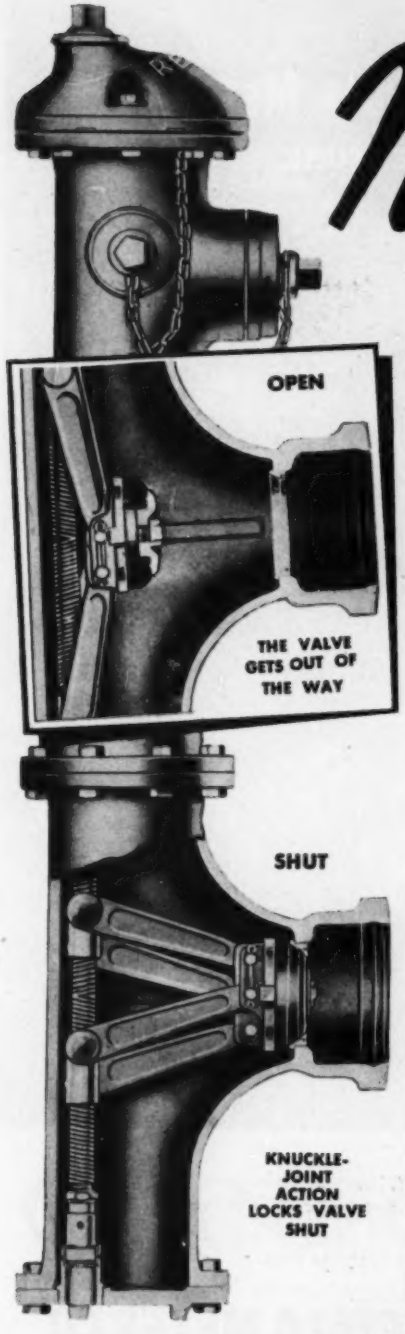
***Porous plates and diffusers by***

# CARBORUNDUM

Trade Mark

**Dept. M-121, Refractories Division** — **The Carborundum Company, Perth Amboy, N. J.**

*"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company*




Above hydrant shown with "hub end" inlet. Also made in "flange end" type; and with mechanical joint.

# No sticking- cussing-

## more water quicker

from every

# RENSSELAER

A hydrant should open quickly and easily—deliver a flood of water fast.

It should shut tight and STAY tight—locked shut and secure.

That's exactly what every Rensselaer Hydrant does. The main valve opens with the pressure. In full open position, the valve is backed against the casing, completely out of the waterway. Loss of head is minimized.

The powerful knuckle-joint action of steel forgings bearing against the case mechanically closes the valve and locks it shut. Valve has special rubber face that will not scar or leak.

Other features include solid bronze vital parts, for long life. Fast non-clog draining. No water-hammer. No flooding if barrel is broken. No digging to repair broken barrel. And one man can easily remove and replace all working parts, without special tools or hoist, just by removing the head.

*There are thousands of Rensselaer Hydrants in satisfactory service. More are being put in all the time. No wonder!*

13

**RENSSELAER**
**VALVE COMPANY**

*Hydrants • Gate Valves • Square Bottom Valves*
*Check Valves • Tapping Sleeves and Valves • Air Release Valves*

**TROY, NEW YORK**

*Division of Neptune Meter Company*

BRANCH OFFICES IN PRINCIPAL CITIES

# SIMPLICITY of AMERICAN METERS

## THE DISTINGUISHING FEATURE

All water meters are sold today under approximately the same claims of quality and accuracy. How then shall a buyer choose intelligently the best meter? Price may or may not be a criterion.

The one important variable among water meters today is simplicity of design. The meter which does its work with the fewest parts is the most efficient, the most advantageous over many years. That meter is the American.

Ask for complete data.

**BUFFALO METER CO.**

**2909 MAIN STREET, BUFFALO 14, NEW YORK**

# FOR BETTER SAFER HANDLING OF CHLORINE

## CRANE FORGED STEEL GLOBE AND ANGLE VALVES

Made exclusively for chlorine gas and liquid lines, Crane Forged Steel Globe and Angle Valves give safe and dependable service under all working conditions. Body and bonnet materials are more than strong enough to withstand severe internal and line stresses . . . trim metals are the most practical and efficient for combating the corrosive action of chlorine. For a point by point analysis of these performance-proved Crane Chlorine Valves, see the features below.

**PRESSURE-TIGHT CLOSURE**—45° narrow bearing seat gives high unit pressure to break down hard deposits on seating surfaces; assures tight closing.

**TIGHT STEM SEAL**—Deep stuffing box is filled with chlorine service-tested packing. Can be repacked under pressure when valve is wide open.

**EXTRA TIGHT BONNET JOINT**—Male and female bolted bonnet joint retains corrugated soft Monel gasket; reduces danger of leaks.

**PREFERRED CORROSION-RESISTANT DESIGN**—Outside Screw and Yoke construction keeps stem threads out of contact with line fluids, simplifies thread lubrication.

**TESTING**—These valves are specially tested at 300 pounds air-under-water.

**SEND FOR CIRCULAR No. 320**

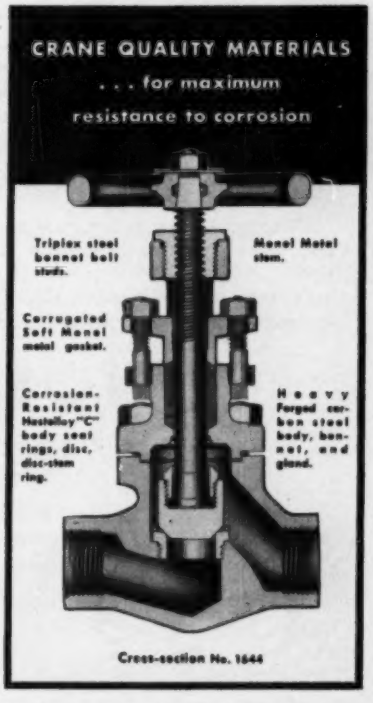
For further information about these and other Crane corrosion-resistant valves—ask your Crane Representative or write for your copy of Corrosion-Resistant Piping Materials Circular No. 320. No obligation.

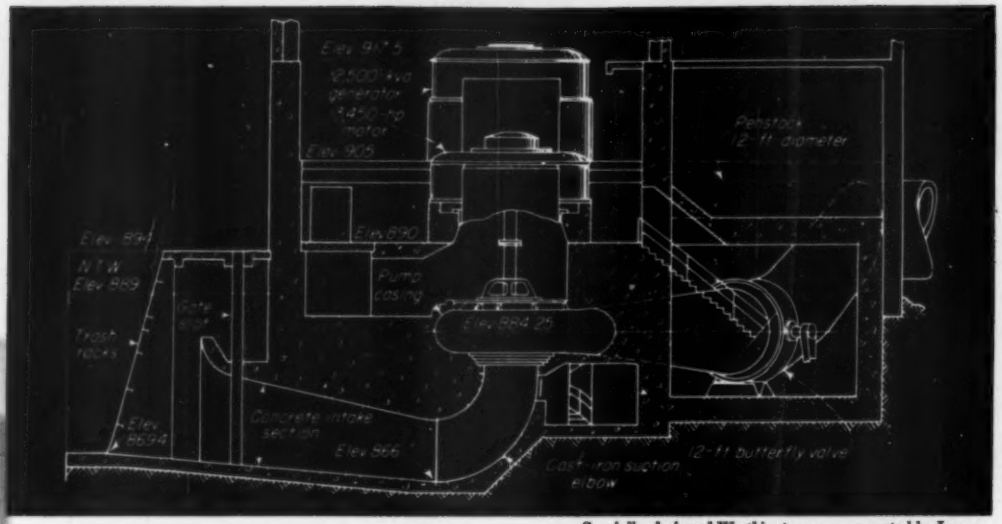
# CRANE CO.

*General Offices:* 836 S. Michigan Ave., Chicago 5, Ill.
*Branches and Wholesalers Serving All Industrial Areas*

**VALVES • FITTINGS • PIPE**
**PLUMBING • HEATING**

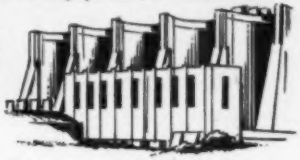
**No. 1644, Forged Steel Globe for water-free chlorine services up to 300° F. Sizes: ½ to 2-in. Also in Angle patterns, No. 1645**


CRANE QUALITY MATERIALS
. . . for maximum
resistance to corrosion
Triplex steel bonnet bolt studs.
Monel Metal stem.
Corrugated Soft Monel metal gasket.
Corrosion-Resistant Hastelloy "C" body seat rings, disc, disc-stem ring.
Heavy Forged carbon steel body, bonnet, and gland.
Cross-section No. 1644




*Specially-designed Worthington pump operated by Lower Colorado River Authority of Texas, at Buchanan Dam.*

# Big Pump Banks Hydro Energy



## at 360,000 gpm—and low cost!

It's one of the largest in the world—the Worthington pump used for water storage at Buchanan Dam on the Colorado River in Texas.

There are three 12,500 kva generators at Buchanan Dam. The pump is used in connection with the third one. It uses low-cost off-peak energy to store water which can be used at times of peak load.

The cost of running the pump is only one-quarter the value of the peak energy it helps to produce.

This specially-designed pump is rated at 362,000 gpm under 120 ft head, and is driven by a 13,450 hp motor. It has a 164 rpm shaft, bottom-suction, twin-volute, closed-impeller design. The impeller's center line is 4.75 ft below normal tail water level. So the pump is primed at all times and there is no cavitation of the impeller.

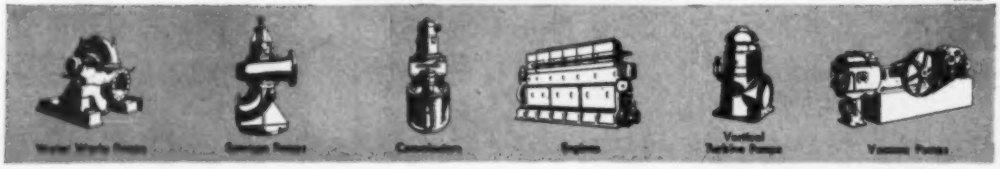
**Standards—Specials—a Complete Line**

It's another case that proves *there's more worth in Worthington*—proves that Worthington can always supply the right pump for the job. It makes no difference whether tremendous quantities of water are involved as at Buchanan or the relatively smaller amounts required by the average municipality. With the broadest and most complete line in the world, it is often possible to select or adapt a standard model to meet specifications. For detailed information, address Worthington Pump and Machinery Corporation, Public Works Division, Harrison, N. J.

**WORTHINGTON**

**PUBLIC WORKS DIVISION**

W.1.5



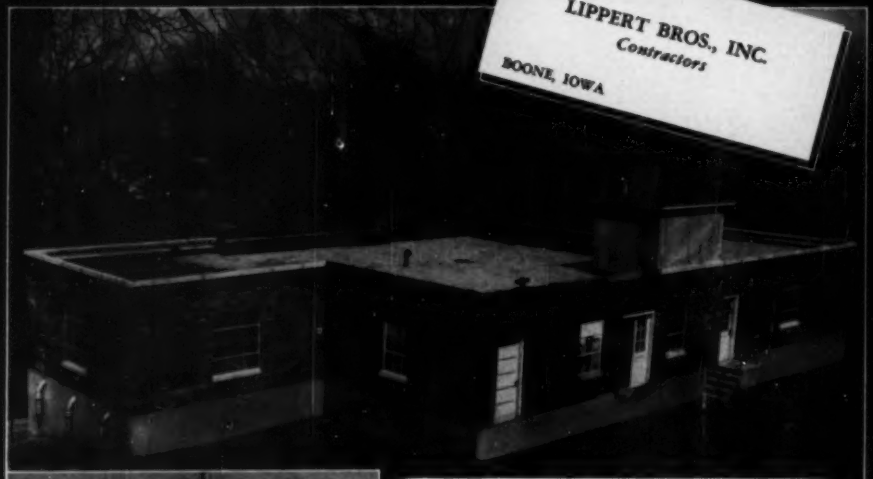
# HUMBOLDT, IOWA

## Water Works

(IMPROVEMENTS COMPLETED IN 1951)

HOWARD R. GREEN CO.
*Consulting Engineers*
CEDAR RAPIDS, IOWA

LIPPERT BROS., INC.
*Contractors*
BOONE, IOWA



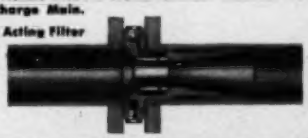
B-I-F Industries Equipment furnished for the Humboldt Water Works:

**Omega #3 Universal Feeder with dissolving chamber, for feeding alum.**

**Omega #2 Universal Feeder with lime slaker, bucket elevator, and dust collector, for feeding quicklime.**

**Builders 8" Insert Nozzle with Flo-Watch Totalizer-Recorder for High Service Discharge Main.**

**Builders 4" Direct Acting Filter Rate Controllers with Loss of Head and Rate of Flow Indicating Gauges.**



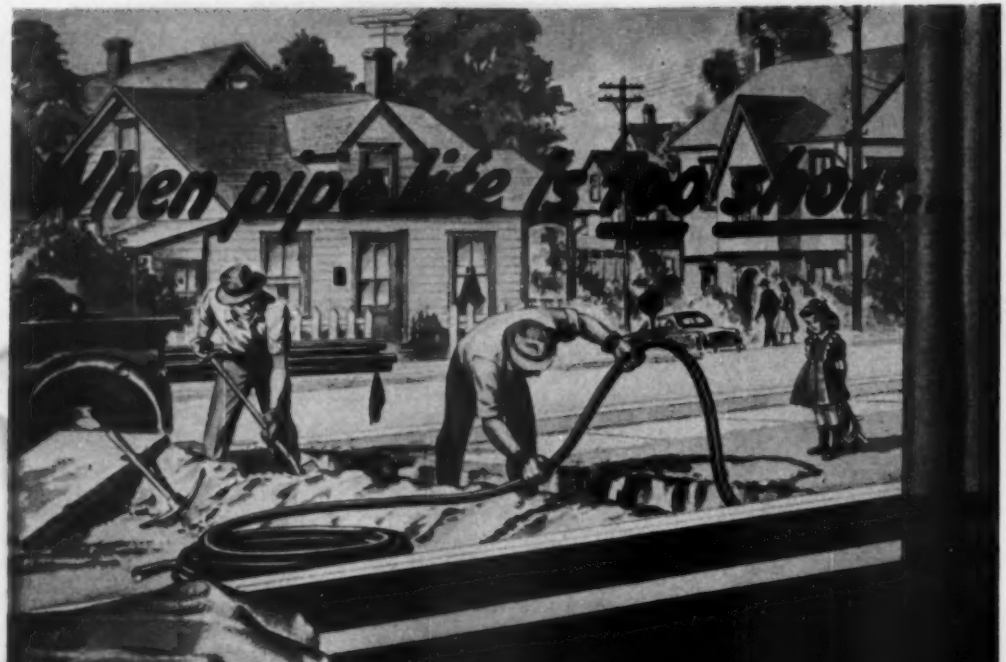
This newly redesigned Water Works treats up to 1 MGD of spring water to supply the water needs of Humboldt's 3500 residents. The plant's reconstructed settling basins use the upflow principle with chemical treatment to perform the necessary settling and softening operations, prior to filtration in rapid sand filters.

Builders Flow Meters, Rate Controllers, and Gauges were selected to implement the treatment process. This modern equipment is an important aid to Henry Christensen, Plant Supt., in his efficient operation of the Humboldt Water Works. For Bulletins describing Builders Water Works Equipment, address Builders-Providence, Inc. (Division of Builders Iron Foundry), Providence 1, Rhode Island.

B-I-F INDUSTRIES

**BUILDERS-PROVIDENCE**

BUILDERS




## SPECIFY CARLON PLASTIC PIPE!

Costly, periodic replacement of water lines because of electrolytic corrosion or interior build-up is reduced to minimum when CARLON plastic pipe is installed. This new pipe is guaranteed against rot, rust and electrolytic corrosion, and its smooth internal surface will not accumulate rust or scale. CARLON pipe assures permanent free flow and features a trouble-free service life many times longer than ordinary pipe.

CARLON pipe service line installations can be accomplished quickly and easily because of its extreme light weight. Flexible types, furnished in long lengths, require fewer fittings per installation and can be curved to follow ditch line or structural contour. Rigid CARLON is supplied in threaded and coupled random 21-foot lengths. In addition, a complete line of plastic fittings incorporating standard I.P.T. is available for connecting both types of CARLON plastic pipe to established systems. Complete adaptation from corporation stops to CARLON pipe is provided through standard adapters.

Remember, for longer pipe life, specify CARLON . . . THE FIRST REAL PIPE THAT IS PLASTIC!

At present, raw material shortages are limiting the production of certain types of CARLON pipe. Every effort is being made, however, to overcome this problem and to meet the growing demand and need for CARLON plastic pipe.

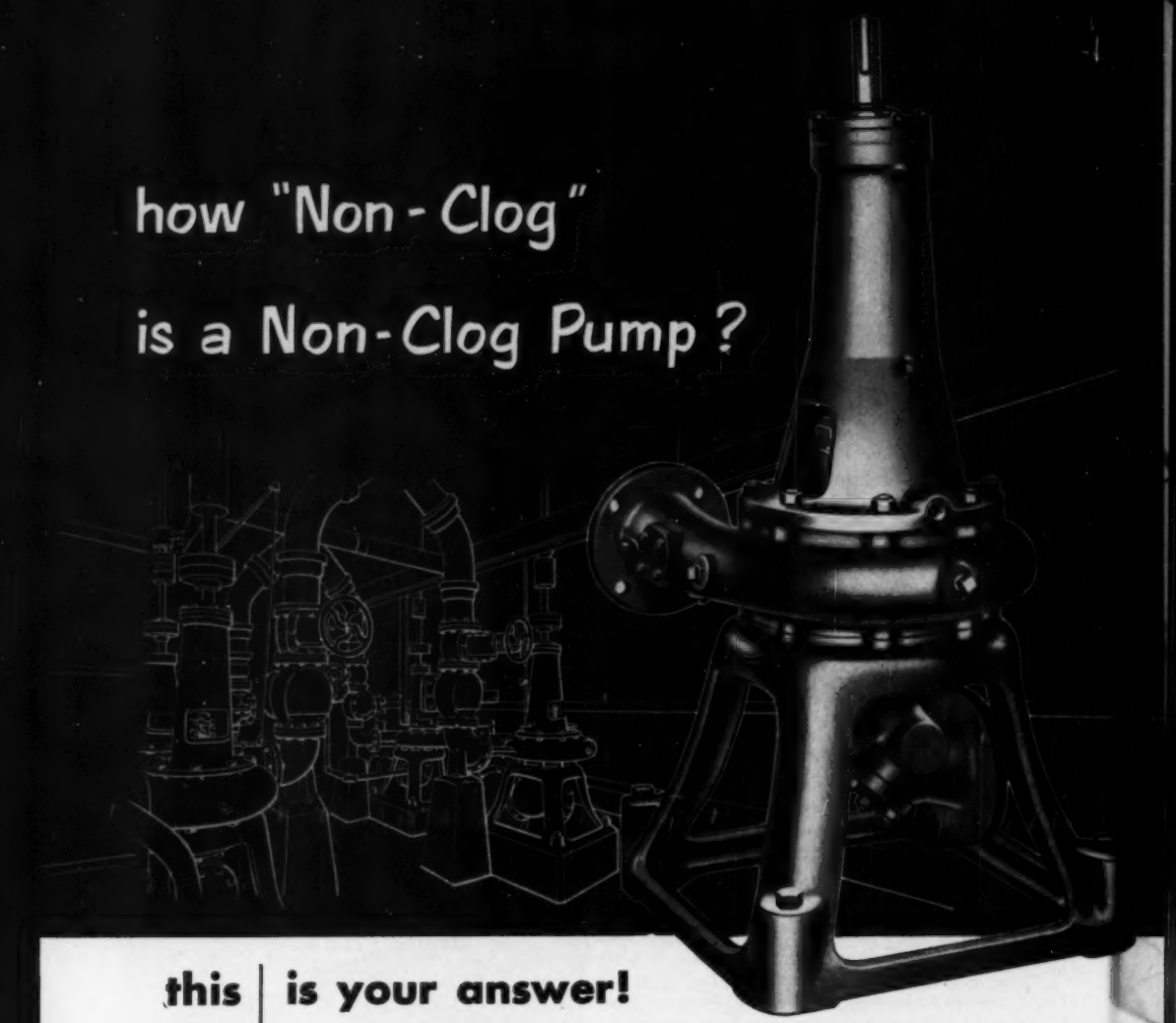
CARLON CP

**CARLON PRODUCTS CORPORATION**

IN CANADA MICRO PLASTICS, LTD. ACTON ONTARIO

10122 MEECH AVENUE • CLEVELAND 5, OHIO

# how "Non-Clog" is a Non-Clog Pump?



## this is your answer!

Any sewage and trash pump can be clogged! But the Fairbanks-Morse *Bladeless* Impeller Pump is up to 25 times more "non-clog" than any other pump. WHY?

A sewage and trash pump clogs because fibrous trash catches on impeller blades and eventually builds up to the point where the pump "clogs." But the Fairbanks-Morse Impeller has no blades! It's a "whirling tube" with no blades or projections to catch and hold trash. In tests, even a man's complete coverall went through a 4-inch pump without clogging. In actual operation, reports prove that the Fairbanks-Morse Bladeless Impeller Pump rarely has to be dismantled to clear "clogged impellers." With previous pumps, they had to be dismantled as often as twice daily. If any pump can be called "non-clog," Fairbanks-Morse is it.

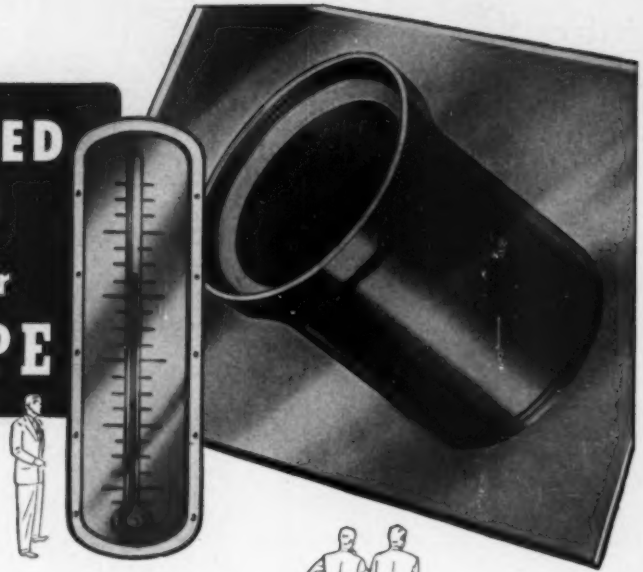
And a bonus advantage with Fairbanks-Morse: for a specific solids size, the Bladeless Impeller Pump delivers approximately 50% of the capacity of conventional sewage pumps. Thus, you do not flood filter beds in periods of low flow. This reduced capacity also permits use of smaller driving motors, assuring lower initial and operating costs.

Why not have your Fairbanks-Morse Pump Distributor or Local Branch Office give you the whole story? Or, if you prefer, write Fairbanks, Morse & Co., Chicago 5, Ill.

**FAIRBANKS-MORSE,**
*a name worth remembering*

PUMPS · SCALES · ELECTRIC MOTORS · GENERATORS · LIGHT PLANTS · DIESEL, DUAL FUEL AND GASOLINE ENGINES

# CONTROLLED DRYING Makes Your CLAY PIPE



- STRAIGHT
- ROUND
- SMOOTH

Nature makes Clay Pipe acid-proof and everlasting. It can't corrode, crumble, or rust away. But science works closely with nature to make Clay Pipe the engineer's top choice for every sewerage and drainage job.

Controlled drying keeps Clay Pipe uniformly straight for easier installation, round and smooth for maximum velocity. Warm air is circulated in and around the Clay Pipe, drying it evenly. Thermostats control the temperature. End result: the best pipe for your sewerage and drainage jobs.

When you specify Vitrified Clay, you're selecting the best efforts of science and nature working hand in hand. Together, they produce for you the *only* pipe that *never wears out!*

**NATIONAL CLAY PIPE MANUFACTURERS, INC.**

311 High Long Bldg., 5 E. Long St., Columbus 15, O.
703 Ninth & Hill Bldg., Los Angeles 15, Calif.
100 N. LaSalle St., Rm. 2100, Chicago 2, Ill.
206 Connally Bldg., Atlanta 3, Ga.

SPECIFY *Vitrified* CLAY PIPE

CLAY PIPE NEVER WEARS OUT!

*Seasons Greetings*

AND MANY THANKS FOR YOUR CONTINUED FRIENDSHIP AND SUPPORT

. . . THE CLAY PIPE INDUSTRY

C-451-2

# Proved Performance

## IN MORE THAN A THOUSAND MUNICIPAL WATER SYSTEMS

Calgon* has proved its ability time after time in countless municipal and industrial water systems to control corrosion, prevent lime scale and stabilize dissolved iron and manganese.

Threshold Treatment with Calgon controls corrosion by forming a protective film over all metal surfaces in the water system, thereby insulating them from the oxygen and other corrosive elements in the water. With Calgon on the job, red water and tuberculation, as well as scale deposition, cease to be operating problems.

Our engineers will be glad to discuss your specific water problems with you. For more detailed information, send for free Threshold Treatment literature.

*T.M. Reg. U.S. Pat. Off.

HAGAN
HALL
BUROMIN
CALGON

**calgon, inc.**

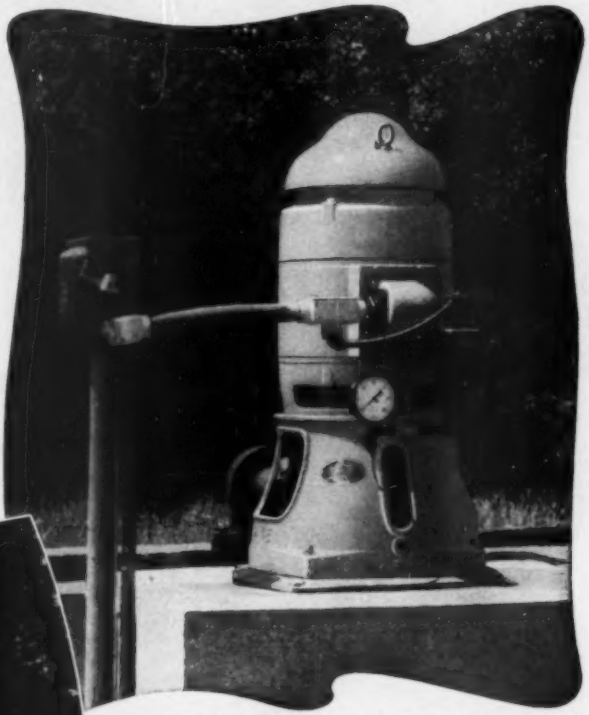
A SUBSIDIARY OF
HAGAN CORPORATION

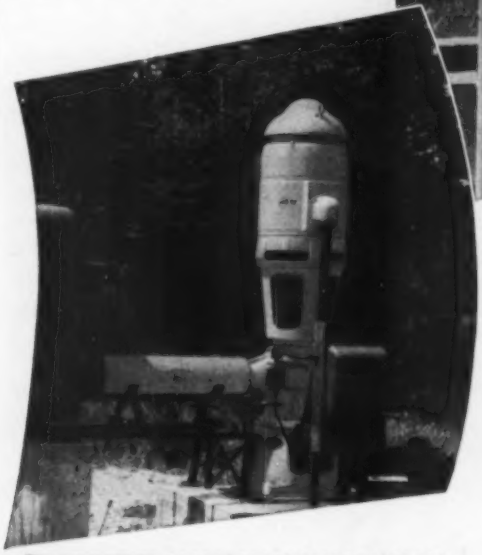
HAGAN BUILDING
PITTSBURGH 30, PA.

## INSTALLED FOR THE CITY OF

# TOMS RIVER, New Jersey

. . . WITH her population more than doubling during the summer season, the resort city of Toms River, New Jersey, was facing a serious water shortage problem. Five old, inefficient and not too dependable wells were being operated with suction pumps. Layne was called in for a discussion of what could be done with limited funds. Layne's recommendations resulted in a contract for the rebuilding and re-equipping of one old well and the drilling and equipping of a new one. The contract also called for equipping one pump with an auxiliary, gasoline engine drive, on one of the pumps, for use in case of electric power failure. Without delay everything was finished according to the contract, giving the city of Toms River a water supply that more than fulfills present needs. The new equipment also greatly reduced operation cost which more than justified the investment.





## *Built Complete by Layne*

Everything, with the exception of some wiring for the Toms River job was handled complete by Layne in one inclusive contract. Each phase of the work was under the supervision and direction of Layne engineers who made sure that all materials and method of installation were up to Layne's very exacting standards. The entire job handled in one contract was an important factor in saving time, extra expense and unnecessary worry for the Toms River city officials. Furthermore it assured the city of obtaining a completely satisfactory job throughout.

**LAYNE & BOWLER, INC.**
**General Offices, Memphis 8, Tenn.**

★★★★★★★★★★★★★★★★★★★★★★★★

**Catalog on Layne**
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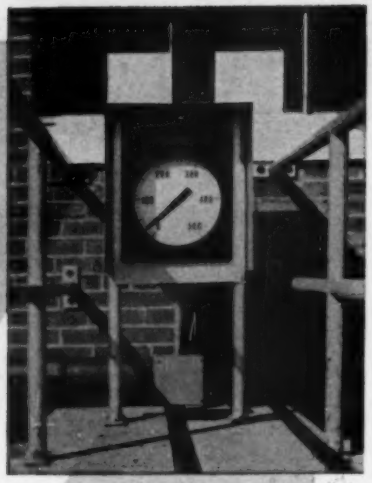
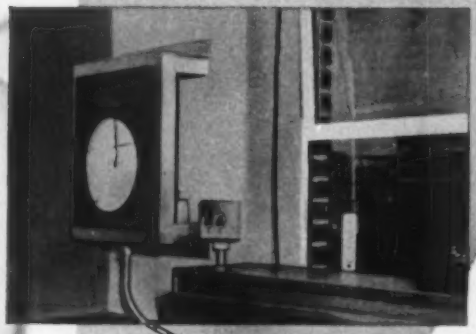
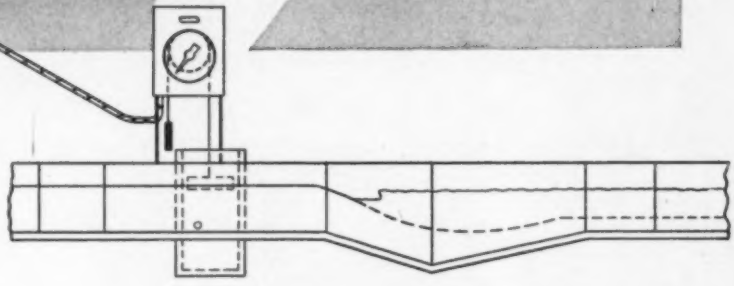
# DEPENDABLE METERING FOR PARSHALL FLUMES...





• FROM INSTRUMENTATION HEADQUARTERS



*In the diagram at right, a float actuated Brown Indicating Flow Meter is shown at the stilling well . . . with transmission line to a remote recording and integrating receiver. Both instruments have an evenly-divided scale which reads directly in terms of flow. Where preferred, the recording and integrating can be accomplished at the flume . . . without an intermediate transmitter.*

In addition to the usual reasons for measuring flow of influent to any sewage treatment plant, there are two other good reasons why you may want to know how much waste-laden water is entering the plant: (1) In order to add the correct amount of neutralizers. (2) In order to ascertain service charges when handling treatment for different localities.

In both cases, *dependable metering* is absolutely essential . . . and you get it with Brown Instruments, backed by the entire nation-wide network of Honeywell branch offices and factory-trained service engineers. Write for Instrumentation Data Sheet 10.3-4.

It will pay you to get full information on Honeywell products for all your instrumentation needs . . . for Digesters, Dryers, Incinerators, Boilers, Mixing Basins, Elutriators, Sludge Lines and Room Heating, in addition to Parshall Flumes. Call in your local Honeywell engineer who is as near as your phone . . . or write for a copy of Catalog 7301 for detailed information on Brown Instruments for Sewage and Industrial Wastes.

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"..for high removals at low cost plus flexibility of operation, we specified...

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PHONE 84591
GOLETA - CALIFORNIA

October 11th 1951

Process Engineers Incorporated
Los Angeles, California

Gentlemen:

In response to your letter of October 10th, 1951, we are pleased to state that in 1948 negotiations were entered into between the Goleta Sanitary District and the Regents of the University of California for the joint construction of a larger disposal plant to serve the new University Campus at Goleta and the resultant increase of population, with the University sharing in the construction costs and the operating expense.

Process Oxidators were chosen after thorough investigation of existing units and upon the recommendation of the consulting engineer, Mr. Philip W. Enights. The reasons for specifying Process Oxidators were numerous but primarily we were seeking low capital and operating costs plus extreme flexibility.

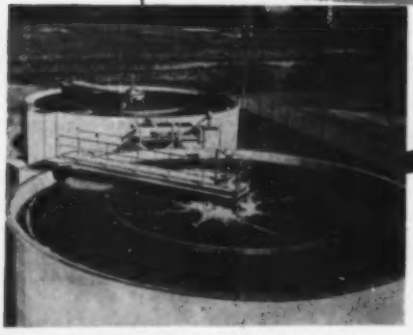
The comparatively inexpensive installation of two 50' Process Oxidators arranged for parallel or series operation with skimming in both units gives us the results of intermediate treatment at a slight increase in cost above plain sedimentation, while we will effect additional economies by lagooning the effluent for polishing which will eventually be used by a commercial concern for cooling purposes.

The flexibility feature is extremely important as in summer when the University is not in session, the demand will be fractional compared with the heavy winter flow once Goleta Campus of the University of California is in full operation.

In brief, although there were many factors that influenced our decision, for high removals at low cost plus flexibility of operation, we specified Process Oxidators.

Sincerely Yours,

Stanley G. Pateman
Stanley G. Pateman
Secretary-Manager



Write to any of the addresses listed below for complete information about this original one tank aeration, coagulation and sedimentation unit with sludge recirculation.

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Substantial savings in pumping power result due to the low pressure drop. The beveled vane ordinarily seated at a 12½° angle means greater control rangeability either manual or automatic and no down-time for cleaning.

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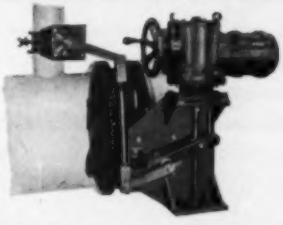
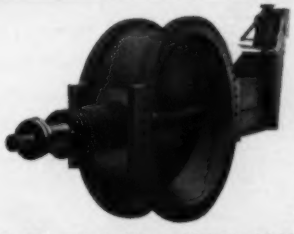


No. 798—Thirty-six inch and eight-inch R-S heavy duty valves of R-S "H" Metal at elevated temperatures for foundry cupola control. When the larger valve is wide open, the smaller valve is fully closed and vice versa. Slow operation is required, hence the motor operator with threaded reachrod.



No. 735—72-inch 125-pound "H" Metal R-S Valve for elevated temperatures. Valve is equipped with dual cooling fins. Oil cylinder and positioner utilizes 200 psig oil and 0-15 psig instrument air. Positioner cam driven simulating straight line semi-log control curve.

*a.c.f. 12SS Lubricated Plug Valves handling sludge and other tadings at Dayton, Ohio Sewage Disposal Plant. Valves are installed beneath floor, operated through stands above floor.*

# NO OBSTRUCTIONS TO TRAP SOLIDS

**There's nothing inevitable about valves becoming jammed with solids. Sludge flows freely through a.c.f. CYLINDRICAL Lubricated Plug Valves... nothing slows the flow. The passage through the valve is streamlined... and has at least as much area as the passage through the pipe! Besides, the CYLINDRICAL plug shears tough, stringy obstructions like a knife! Ideally suited for the special problems of the Sewage Field: a.c.f. CYLINDRICAL Lubricated Plug Valves!**

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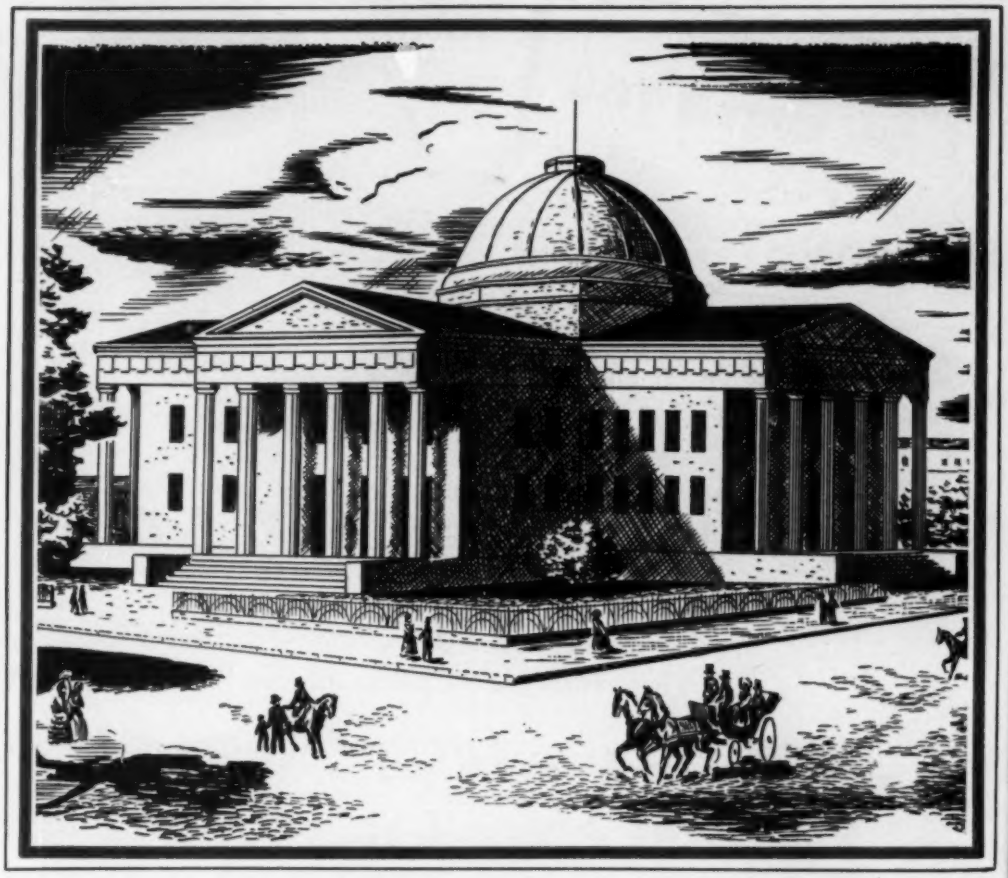

*The old courthouse in St. Louis as it looked 100 years ago*

St. Louis, Missouri has a cast iron water main in service that was installed more than 100 years ago. That is not surprising as St. Louis is one of our oldest cities, founded by the French and taken over by the U. S. A. with the Louisiana Purchase. Yet this old main is still withstanding the traffic shock and beam stresses imposed by multi-ton trucks and congested underground utility services in a great manufacturing city. More than thirty other American cities have cast iron water and gas mains in service that were installed over a century ago—indisputable testimony to the strength factors of long life inherent in cast iron pipe.

**United States Pipe and Foundry Company, General Offices, Burlington, N. J. Plants and Sales Offices Throughout the U. S. A.**

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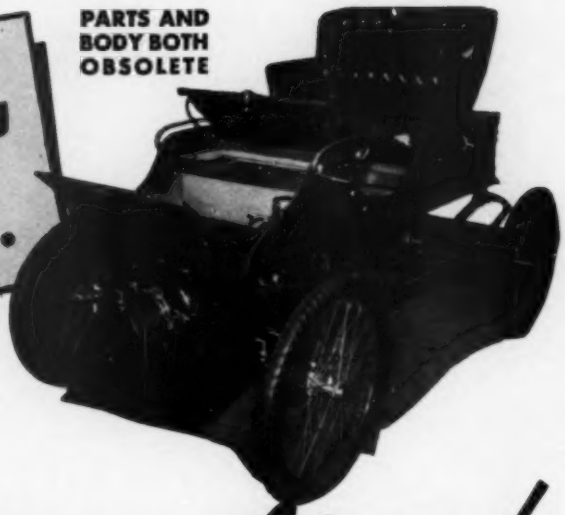
**PARTS AND BODY BOTH OBSOLETE**



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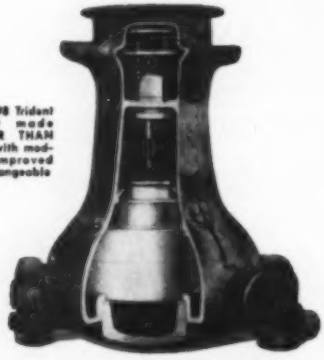
***But when you put MODERN Improved interchangeable parts into an "old" TRIDENT®***

***. . . it becomes BETTER than when new!***



An 1898 Trident Meter made BETTER THAN NEW with modern, improved interchangeable parts.

The Trident policy of interchangeability doesn't mean just replacing old parts in old or obsolete meters. That wouldn't check depreciation! Old meters with "new" old parts are still old, obsolete. No, Trident puts improved modern parts into meters whose unchanged basic design is as sound today as when first sold! So Tridents don't depreciate, don't become obsolete. You save on inventory, too—these same parts are the ones used to repair today's Tridents.

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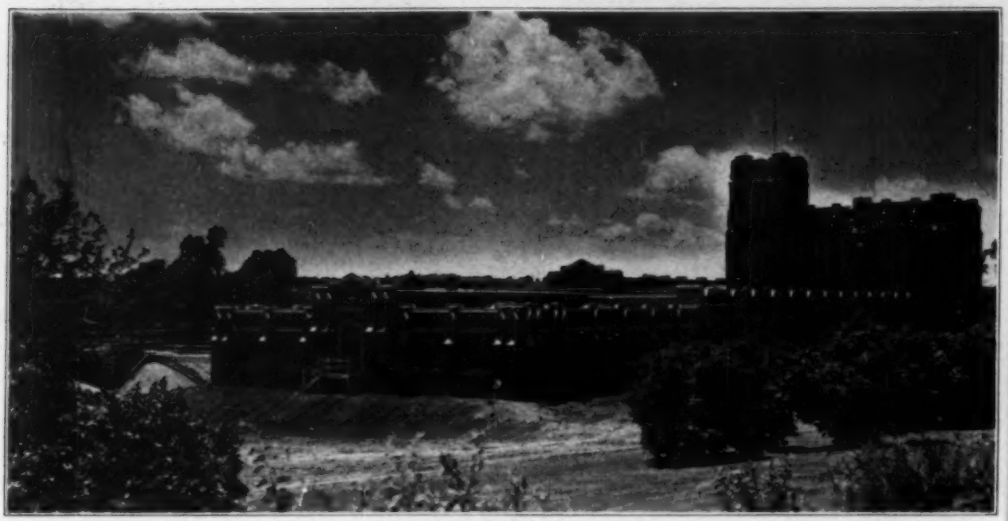
WATER & SEWAGE WORKS

VOL. 98, NO. 12 • A GILLETTE PUBLICATION • DECEMBER 1951



SOFTENING AND FILTRATION Plant of Cedar Rapids, Iowa

# Softening Plant Expansion at Cedar Rapids, Iowa

*by* **F. E. GRUNDLER**, *Alvord, Burdick & Howson Engrs., Chicago, Ill.*

THE Cedar Rapids, Iowa, water purification and softening plant, built in 1929-30 was becoming inadequate in capacity in the late 1940's when Mr. H. F. Blomquist, who was superintendent from September, 1920 to January, 1950, initiated an expansion program. The plant, located about two miles upstream on the Cedar River from downtown Cedar Rapids, replaced an earlier filter plant located near the city's business district.

### 12 MGD Plant Enlargement

Contracts were let in October 1949 for the construction of a 12 M.G.D. addition, doubling the existing plant capacity.

The area of the site is 11 acres, provision for expansion having been made in laying out the plant in 1929. The facilities added in 1949-1951 conform to the earlier plan. As the pictures reveal, the modified Gothic architecture of the original building has been continued in the new filter building. A modernizing trend has been utilized in the elimination of windows in the outside walls of the filter addition, and in the use of glass block in the operating gallery walls above the filter roof—see photograph of Operating Floor.

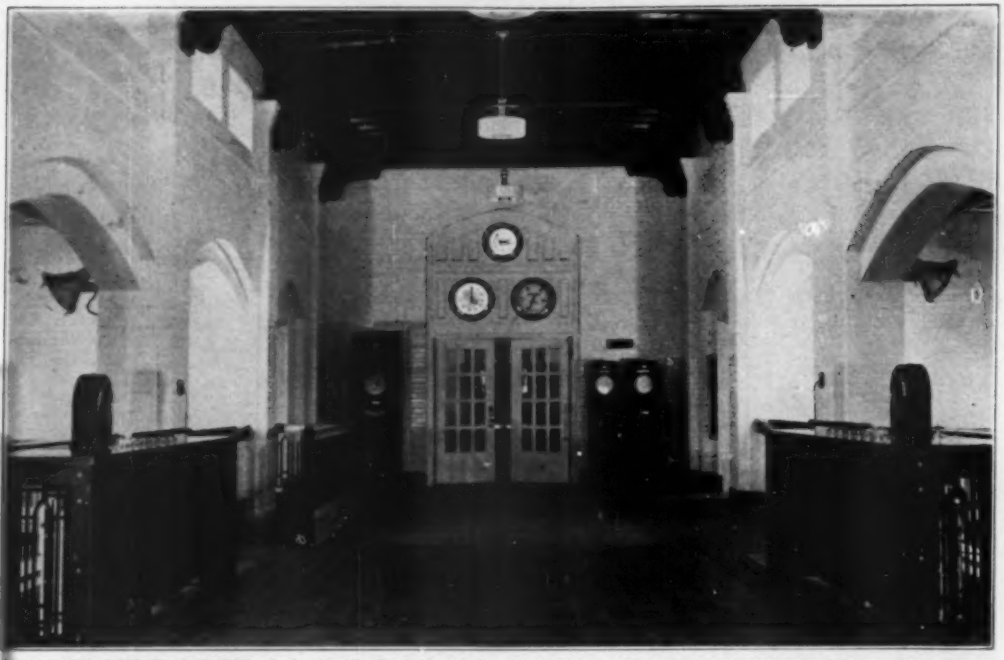
Greater flexibility of operation is an important element gained by the new addition. The number of basins in the original plant has ben doubled. There are now four each of rapid mix, slow mix and clarifier basins and three recarbonation basins. The mixing recarbonating and clarifier basins may be used either in series or parallel operation as required. Chemical solutions are fed at the point desired for the particular method of treatment desired at the time.

### Characteristics of the Water

The source of supply is the Cedar River, which varies from 3 ppm turbidity in winter to 1600 ppm in flood stage, with an average of 140 ppm for the year. The hardness ranges from 80 to 300 ppm and averages 190 ppm. The softened water has an average hardness of 85 ppm. Taste and odor control is an important part of the treatment process during spring break-up of the river ice. The river threshold odor at times reaches 120, the yearly average being 16.

### Chemical Storage and Feed

Chemicals are received in car-load lots. Alum and unslackened lime are unloaded from the cars to over head storage bins by pneumatic conveyor, supplemented by a screw conveyor for



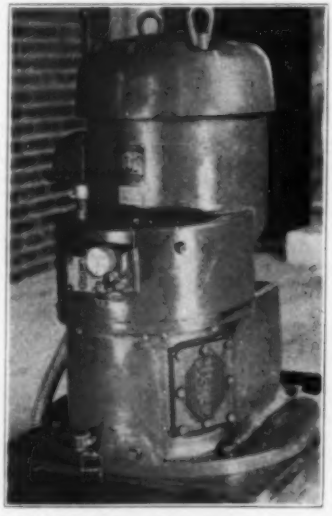
NEW FILTER OPERATING FLOOR—Cedar Rapids Plant. Master Control Panel left of doors; Clock, Back-Wash and Surface Wash Gauge and Wash Tank Gauge over doors; Back Wash and Surface Wash Recorders left of doors. Filters are flood lighted.

distribution to the three original bins. Other chemicals are received in bags. Chemical solutions are fed either at the immediately adjoining old pre-mix basins, or at the new rapid mix basins located four hundred feet away. Alum, ferric sulphate, soda ash and chlorine solutions from the feeders are conveyed in rubber hose in the new chemical feed pipe tunnel to the point of discharge. Milk of lime is conveyed in four inch flanged steel pipe lines, which have several bends of five feet radius.

A flexible cleanout plug slightly smaller than the four inch diameter lime pipe is used once in eight hours. The plug is made of rubber belting spaced by washers with a door spring through the center, the flexible feature being added a eliminate sticking at the turns. The plug is inserted through a gate valve at the inlet end of a pipe and high pressure water, controlled by a quick opening valve, rapidly forces the plug to the discharge end of the line. This method of cleaning the new lime feed pipe lines has been working satisfactorily for several months.

### Chemical Usage Determined by Jar Tests

The choice of chemicals and point of application is determined by the jar test. With average raw water conditions, alum is generally preferred as a coagulant in the first series of coagulation and settling. Because alum is not available at one period, ferric sulphate was used in the first basins for about a month.



RAPID MIX motor and gear-reducer. Vertical shaft with propeller blade extend into Rapid Mix Chamber beneath.

With the mud partially removed in the preliminary basins, the new final mixing and clarifying basins are generally used for the softening process. Ferric sulphate is preferred as a coagulant in the softening stage, because at pH values above pH8 it is more efficient than alum.

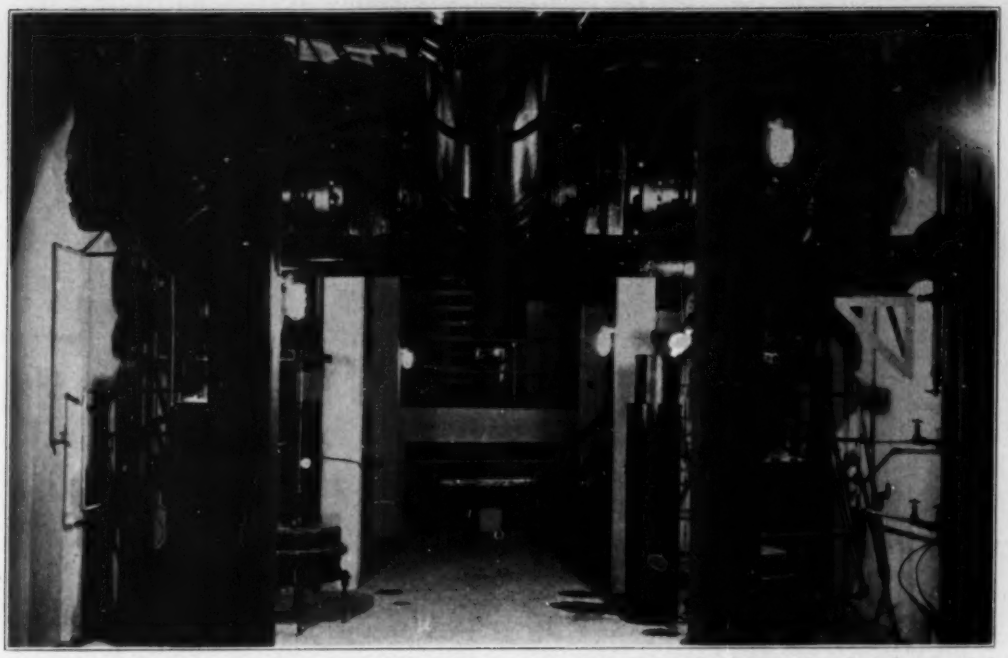
### Mixing and Clarifier Basins

The two original rapid mix basins are located in the chemical building. The original slow mix basins are 50 ft. square and equipped with paddles suspended from a horizontal arm revolving about a centrally mounted a vertical drive shaft.

The new rapid mix chambers adjoin the new slow mix basins, which are located between the old and new clarifier basins. They are of the vertical shaft propellor type with bottom inlet.

The slow mix basins are of the horizontal shaft Jeffrey "Floctrol" type with fixed baffles having ports centered on the shafts and shaft mounted port baffles, all designed to minimize short circuiting of the water.

The new slow mix basins have reinforced roof slabs covered with a foot of earth to eliminate freezing. The temperature of the water is about



NEW PIPE GALLERY—Cedar Rapids Plant. 24" wash line center; 8" surface wash line below it. Simplex 3 mgd Rate Controllers in vertical position right and left make for roomy and light gallery.

34 degrees for several winter months. The open clarifier basins have up to 30" thickness of ice some years.

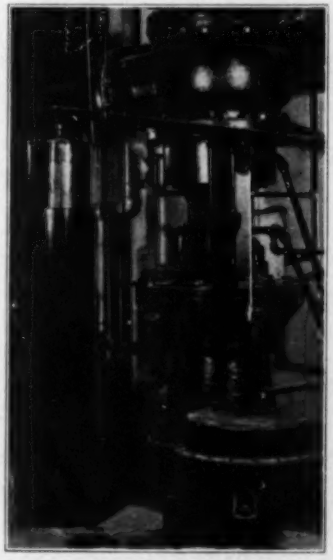
### Operating Conveniences

Convenience of operation is greatly appreciated by plant personnel but is frequently overlooked in the construction of water treatment plants and pumping stations. On this project two items not commonly found were added.

First, a bridge connects the new filter building with the clarifier basins. Second, the embankment slopes around the basins were made 2½ to 1 so that a power lawn mower can be used on them with a minimum of difficulty.

All four of the clarifier basins are one hundred feet square. The two basins built in 1929 were of the cross-flow type. Because funds to equip both were not available at the time, one was used as a plain sedimentation basin without sludge collectors. This old basin and the two new basins have been equipped with center feed Dorr Clarifier mechanisms. These clarifiers have operated efficiently even though two feet of ice covered the water surface outside the center ice shield.

The clarifier basins have a conical bottom to facilitate the sweeping of settled sludge to the center hopper for removal by continuous pumping. A six inch sludge line runs beneath the clarifier basins to the rapid mix house where the sludge pump is located. Part f the sludge is returned to the rapid mix basins as an aid in coagulation. The excess sludge is discharged to a waste drain leading to a sludge lagoon.



CLOSE-UP of one of the Vertical Simplex Rate Controllers on four new 3 mgd filters. Note space saving advantage.

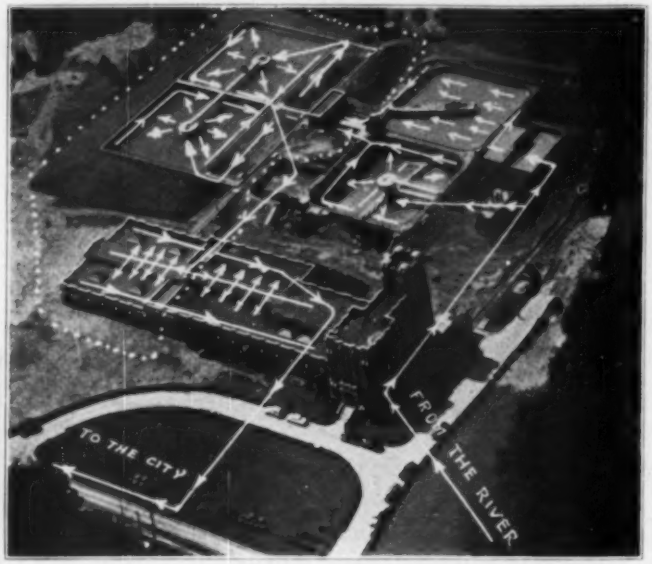
Gravity drainage of the clarifier basins for inspections and cleaning is through 24" wall drain at the floor level and a 10" shear gate at the bottom of the center influent riser. The drains were designed especially for this job. The basins are drained in the spring and fall, two hours being required to empty these million gallon basins.

### Vertical Rate of Flow Controllers Save Space

Vertical type Simplex rate of flow controllers from the filters have been installed on this project. The advantages are a cleaner pipe gallery with more free space, and also a more economical installation. This type of installation is generally used with a clear well underneath. Rate controllers in vertical position have also operated successfully over a period of years in other plants designed in our office.

### Addition to Lime Storage

The need for additional chemical storage is being met by converting the present 100,000 gallon wash water




AERIAL VIEW of plant showing paths of water flow. Additions within dotted line double size of plant to 24 mgd capacity.

tank, located over the plant entrance, to lime storage. A new wash water basin has been constructed outside of the building.

A 1,000 pound an hour lime feed machine will be installed in the present plant office just beneath the west half of the tank. A 750 pound an hour lime feed machine will be installed in the present store room located across the entrance lobby from the office and beneath the east half of the tank. Hopper bottoms are being built to convert the wash water tank to lime storage and it will be filled by means of an extension of the screw conveyor serving the present three chemical storage tanks.

A 150,000 gallon concrete wash water tank is being built underground in Shaver Park on the hillside across the road from the filter plant.

The present chemical laboratory will be used as a plant office, equipped with short wave radio transmitter for emergency and routine direction of repair crews on the distribution system. Three cars and five repair trucks will have two way radio transmission equipment.

New air conditioned separate chemical and bacteriological laboratories will be located in two new rooms provided between the old and new filters.

### Contracts

Rapid Mix Equipment, International Eng. Co., Inc., Dayton, Ohio ..... $ 3,504.00
Slow Mix Equipment, The Jeffrey Mfg. Co., Columbus, Ohio ..... $ 12,940.00
Clarifiers, The Dorr Co., Stamford, Conn. $ 48,380.00
Filter Equipment, Roberts Filter Mfg. Co., Darby, Pa. ..... $150,870.00
General Contract, Greene & Gust Co., Chicago, Ill. ..... $577,000.00
Wash Water Tank and Shop, Loomis Bros., Cedar Rapids, Iowa ..... $ 54,000.00

### Personnel

Leo Louis, Jr., Sup't. of Water Works;
Arnold Cherry, Chemist;
B. N. Coates, Plant Sup't.;
Jess Tarnoski, Sup't. for Greene and Gust Co.;
Henry Cloutier, Sup't. for Roberts Filter Mfg. Co.

The writer was resident engineer for Alvord, Burdick and Howson, designers of the addition.

*Acknowledgment:* The photographs used in illustrating this article were made at my behest by Lincoln A. Zarub of Cedar Rapids.—F.E.G.

CEDAR RAPIDS FILTRATION PLANT EXTENSION
(Facilities Added)

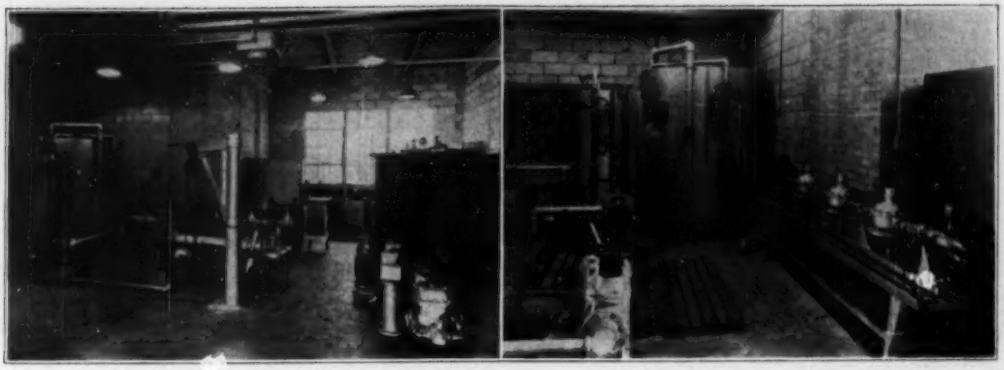
| Reinforced Concrete Basins | Plan Size | Water Depth | Det'n. at 12MGD | Equipment and Suppliers |
|---|---|---|---|---|
| Rapid Mix (2 units) | 10' x 11' | 14'-9" | 1.5 min. | Propellor type mixing mechanism—by International Engineering, Inc. |
| Slow Mix (2 units) | 35' x 90' | 14'-3" | 40 min. | Longitudinal shaft with paddles variable speed motor drive in dry well—by Jeffrey Mfg. Co. |
| Recarb.-Basins (2 units) | 10' x 31' | 14'-3" | 4 min. | Lead pipe grid for Carbon Dioxide—by Roberts Filter Mfg. Co. |
| Clarifier (2 units) | 100' x 100' | 14' | 2.33 hr. | Door Clarifiers. 2 units for new basins 1 unit for old basin—by The Dorr Co. |
| Filters (4 units) | 30' x 38'-6" | | 2 gal. per sq. ft. per min. | Rate controllers—by Simplex Valve & Meter Co.; Meters—by Builders-Providence, Inc. |
| | | | | Cast iron pipe underdrains plus 29" graded gravel 2½" to torpedo sand, 22" filter sand—by Roberts Filter Mfg. Co. |
| Clear Well (2 units) | 30' x 78' | | | Storage, 500,000 gals. |
| Shop | 31'-4" x 47' | one story | | Additional floors to be constructed when needed for chemical storage. |
| Wash Water Tank | 40' x 40' | | | Capacity, 150,000 gals. |
| Lime Storage | Existing overhead wash-water tank being converted; storage capacity 400 tons. | | | |

## $2,874,810.00 Sewage Contract Awarded by Arlington County, Va.

Thompson-Starrett Co. of New York City has been awarded a contract for $2,874,810.00 to construct a treatment plant for Arlington County, Virginia, just across the Potomac River from the nation's capital.

The sewage treatment plant has been designed by Alexander Potter Associates, consulting engineers of New York, and will require about eighteen months to complete. The extension of the present sewage treatment facilities are acutely needed because of the fast growing population of this Washington, D. C. suburban area, and is a part of the general program to clean up the bad pollution problems in the Potomac area.

Thompson-Starrett is also now completing Brooklyn's Owl's Head Pollution Control Project which is a major unit in New York City's long range progressive sewage treatment program.



TWO VIEWS of P.S.W. Co.'s new test room for large meters

# A Meter Testing Room for Large Meters

*by* CHARLES J. MURRAY, *Meter Sup't.,*
*Philadelphia Suburban Water Co., Bryn Mawr, Pa.*

LIKE most growing businesses, our meter shop has been pressed for room. Several years ago in order to make room for the testing of smaller meters, the large meters were moved several miles away from the office to a pumping station where the space was available to do this testing work.

We now have a new Operations Building constructed adjacent to the main office. When this building was designed, a certain portion of it was set aside for a meter shop for the testing of large meters, with ample water supply, good drainage and truck access. After placing this meter shop in service and seeing how well it worked, we thought that a description of it might be of use to other water utilities. We accordingly had the accompanying photographs made of the room and equipment.

Table 1
TESTING PROGRAM

| Meter Size | Meter Type | Registration Between Tests |
|---|---|---|
| 1½" | Disc | 5 Million Gals.* |
| 2" | " | 10 Million Gals.* |
| 3" | Compound | 15 Million Gals.* |
| 4" | " | 30 Million Gals.* |
| 6" | " | 45 Million Gals.* |

*All 1½" and 2" meters are tested every 4 years, even though registration has not reached the limits indicated. Meters of 3" and larger are tested in place, and at least annually.

The Philadelphia Suburban Water Co. serves a population of approximately 470,000 in 300 sq. miles of area, adjacent to Philadelphia to the west and north. It sells water service in 49 different municipalities through about 120,000 services. In this article, Mr. Murray tells of a new meter shop which was recently placed in service for handling large meters only.

That on the left was taken through the overhead truck door and shows the jib-crane for handling the larger meters. That on the right shows rack for testing 3, 4 and 6 in. meters on left and the 4-unit Ford Hydraulic Clamping Tester for 2 in. and smaller meters on right. In center background the battery of 3 Ford Calibrated Test Tanks—1000, 100 and 10 gal. units. Each is equipped with a Testerate Indicator for setting flow rates and watching water level in test tanks.

The testing room was provided with an overhead rolling door so that the meter repair truck can back in directly within reach of a jib crane. Thus the meters acn be loaded and unloaded by one man. As the large meters are unloaded, they are set on castored dollies so they can be moved easily.

As the meters are received, they are given a cursory check in order to determine their relative condition. They are then torn down and cleaned. In general, due to the character of our water, there is but little scale formation and a brush and running water will clean the used meters easily. The meters are then reassembled, using new parts where necessary and when completely assembled, they are tested. Testing is carried out by means of modern testing equipment.

Table 1 shows the schedule we follow in testing and repairing meters in the new shop.

Table 2 shows test flows and accuracy limits required.

After meeting the test on all flows, the meters are painted; the iron case meters with asphaultum, the bronze case meters with bronze paint. The unit is then ready for service.

Table 2
TEST FLOWS AND ACCURACY LIMITS
*(99 to 101% Accuracy Required)*

| Size | Test Rates of Flow (G.P.M.) | | | | | |
|---|---|---|---|---|---|---|
| 1½" | 100, | | 30, | 15, | 5, | 1 |
| 2" | 165, | 50, | 30, | 15, | 5, | 1 |
| 3" | 250, | 50, | 30, | 15, | 5, | 1 |
| 4" | 250, | 50, | 30, | 15, | 5, | 1 |
| 6" | 250, | 65, | 30, | 15, | 5, | 1 |

Note: 1½" meters are all of disc type; 2" meters are of both disc and compound; 3" and up are all compound meters.

The disc side of compound meters is tested down to ¼ gal. per min. flow.

## Automotive Vehicles

### Their Keep and Upkeep

Is an excellent manual for the amateur or professional automobile mechanic and maintenance personnel. It does not discuss specific vehicles, but covers automotive vehicles in general. It covers engines of all types, electrical systems and related units, power trains and chassis components. Simply written and thoroughly illustrated, it constitutes a convenient 461-page reference manual for mechanics, chauffeurs and automotive maintenance crews. The price is $1.50 and is procurable as Catalog M-101.18—2700 from The Supt. of Documents, Gov.'t. Printing Office, Washington, D.C.

# Fluoridation of Public Water Supplies*

From the viewpoint of a water works operator.

*By* WENDELL R. LaDUE, *Supt. & Chief Engr., Bureau of Water & Sewerage, Akron, Ohio*

WATER works operators, nationwide, have always taken pride in their function of providing purified water beneficial for human consumption. In the treatment processes they have removed many compounds and substances which, up to now, have been considered harmful or obnoxious to the consuming public. Recently, however, medical and engineering science and research are showing, to a gratifying degree, that the element fluorine, in the form of the fluoride ion when present—naturally or artificially—in drinking water in proper controlled amounts, can assist in reducing the prevalence of dental caries —common tooth decay—one of man's most discouraging ailments.

Of all methods now employed as a partial preventive or deterrent to dental caries—toothbrushing, restriction of concentrated sugar consumption, and the topical application of sodium fluoride—the fluoridation of public water supplies appears to offer the greatest hope to rising generations. Its application to public waters as a corrective can be accomplished with the greatest east and the most economy.

No modern development affecting the public health through preventative measures has created so much widespread public attention as has fluoridation practices, since experimental installations were inaugurated six years ago in five American cities—notably, Grand Rapids, Mich. and Newburgh, N.Y.

It has been demonstrated that maximum tooth benefits to oncoming generations can be expected when drinking water contains a controlled fluoride content, ranging from 1.0 to 1.5 ppm. If present in smaller amounts, inadequate protection is afforded; if greater, and especially beyond 5.0 to 6.0 ppm., bad mottling of teeth will result.

### Acceptance

Recognizing the trend in public attention, the American Water Works Association, at its June, 1949 Conference in Chicago adopted by resolution this statement of policy with reference to the Fluoridation of Public Water Supplies:

"In communities where a strong public demand has developed and the procedure has the full approval of the local medical and dental societies, the local and state health authorities and others responsible for the communal health—water departments or companies may properly participate in a program of fluoridation of public water supplies."

At the Miami Conference in May, 1951, the A.W.W.A. Board of Directors again issued a statement to the effect that after two more years of experience, its 1949 position had been shown to be sound, and was, therefore, reaffirmed. It declared further that:—

"Recommendations for water fluoridation are the perogatives of the dental, medical and public health groups. When the proper authorities approve the treatment, it then becomes the function of the water works utility and industry to follow through willingly and intelligently where proper controls are assured."

### Endorsements.

On November 2, 1950, the House of Delegates of the American Dental Association, at its annual convention in Atlantic City, N. J., adopted a resolution endorsing the fluoridation of municipal water supplies and recommending the continuation of controlled studies on the subject. The text of the resolution follows:—

"WHEREAS, numerous studies have demonstrated a decreased incidence of dental decay associated with the presence of fluoride occurring naturally in drinking water, and

WHEREAS, there is a rapidly accumulating body of data derived from direct studies of the artificial addition of fluoride to drinking water, and

WHEREAS, these data provide convincing evidence of the safety of this procedure and of its benefits in terms of reduced incidence of dental caries, therefore be it RESOLVED, that in the interest of public health, the American Dental Association recommends the fluoridation of municipal water supplies when the fluoridation procedure is approved by the local dental society and utilized in accordance with the standards established by the responsible health authority, and be it further RESOLVED, that the American Dental Association recommends the continuation of controlled studies of the benefits derived from the fluoridation of water supplies."

The following are excerpts from Resolutions by other national organizations:

U. S. Public Health Service—

"Using scientific methods and procedures, communities desiring to fluoridate their communal water supplies should be strongly encouraged to do so."

State and Territorial Dental Health Directors—

"RESOLVED, that the State and Territorial Dental Health Directors recommend the fluoridation of public water supplies for the partial control of dental caries, where the local dental and medical professions have approved this program and where the community can meet and maintain the standards required by the state health authority."

Governing Council of the American Public Health Association—

"WHEREAS, accumulated evidence indicates a sound basis for the fluoridation of public water supplies for the partial control of dental caries; therefore, be it RESOLVED, that this procedure be recommended as a safe and effective method for reducing the prevalence of dental caries."

American Association of Public Health Dentists—

"RESOLVED, that the American Association of Public Health Dentists recommend and encourage the fluoridation of public water supplies for the partial control of dental caries where the community can meet and maintain the standards required by the state health authority."

### Responsibility

The water works man recognizes that he is not in a technical position

*A statement made before the Am. Public Works Assn., Sept. 1951, which is here published by permission.

to recommend fluoridation. Dental, medical and public health groups exercise such perogative. However, the water works man owes to his community and to his profession an obligation to acquire full knowledge of methods, chemicals and the applications and other "know-how" required to follow through upon evident public demand. He must be ready and informed to answer customer inquiries, regardless of the prevailing attitude toward water fluoridation. Good public relations rests largely upon good public information.

### Methods

The methods for feeding of chemicals to effect fluoridation are not greatly different from those used in handling other common water works chemicals. Both dry and solution feeders are used with success. Dry feeders are readily synchronized to filtering and pumping equipment, while solution feeders are designed to offset corrosive tendencies of solutions containing fluorine. Likewise, the expense of installation of equipment for fluoridation, except for the precautions necessary to protect workers from the presence of toxic dusts and corrosive solutions, is little if any greater than that for feeding other water works chemicals. In general, small water works use solution feeders, while large installations are usually of the dry feed type.

### Chemicals

In fluoridation numerous fluoride compounds may be used with varying degrees of satisfaction. A brief reference to the most commonly used follows:

*Sodium Fluoride (NaF)*—Commercially available in large quantities; convenient to feed; relatively high solubility over good temperature range; toxicity and physiological effects well known and relatively easy to control.

*Calcium Fluoride ($CaF_2$)*—The cheapest source of supply; difficult to feed due to very low solubility; may become preferable for large users where direct feeding can be accomplished.

*Sodium Silicofluoride ($Na_2SiF_6$)*—Predicted to become the most promising source of fluoride; cheap; relatively easy to handle; available in easily increased quantities.

*Hydrofluosilicic Acid ($H_2SiF_6$)*—Expensive; but can be used for direct feed; corrosive and dangerous to handle; therefore, requires very expert attention.

*Hydrofluoric Acid (HF)*—More expensive; can be used in direct feed; requires very expert supervision due to corrosiveness and dangers in handling.

The first three are commercially available in dry form. The latter two are liquids.

### Operating Costs

It is generally expected to charge the cost of fluoridation against the budget of the community for health work. However, it is readily conceded that this is a matter for local determination. Costs will vary with the source of supply, quantities purchased, chemicals used, and of course, are subject to the vagaries of the present day spiralling market.

Reported material costs range from 6c to 18c per capita per year, fluctuating somewhat with the amount of fluorine naturally present in the raw water, the chemical used, and the characteristics of the community with respect to per capita consumption for domestic and industrial needs. Expressed in cost per million gallons treated, reports range from $1.50 to $3.00 depending again upon local conditions and the chemical market.

### Conclusions

Water fluoridation is the extension of standardized water treatment procedures designed to improve the general dental health of the participant consumer. Fluoridation is not expected to become a cure-all, and tooth decay will not be entirely eliminated. However, countless youngsters, from birth to fourteen years of age or during the formative years of dental development, will be spared most of the discomfort and ravages of dental caries. Dental health practices must still be observed, but oldsters will realize the benefits of protection during years of tooth growth.

Dental, public health and water supply authorities look with favor upon the potentialities of fluoridation; so much so that about 100 communities are now known to be using the method in some 21 states. The number is growing rapidly and 95 others have been approved.

Due to differences in temperature and relative humidity between the northern and southern states, fluoride concentrations may eventually fluctuate up or down, respectively, from its accepted 1.0 ppm. standard, with correspondingly better results.

No observable ill effects on human beings have been recorded or evidenced due to artificial fluoridation at the recommended controlled concentration.

Several chemical compounds produce fluorides when applied to water. The present cost of which is not excessive when considering the benefits.

Both dry feed and solution feed machines, commonly used in water treatment, are readily adaptable and obtainable for fluoridation.

Little additional expense is involved in providing suitable safeguards for plant personnel operation. Plant attendants, skilled in the common practices of water treatment, are readily trained in the application of fluoride-bearing chemicals.

Considering the benefits to be expected, the cost of fluoridation is by no means prohibitive, ranging from 6c to 18c per capita per year or $1.50 to $3.00 per million gallons. Costs will vary with the characteristics of the community supplied and the chemicals used.

The Grand Rapids experiment (set for fifteen years in 1945) after only six and a half years of operation, has produced such gratifying results, that the Grand Rapids Press reports a documentary film is being prepared for public information. Using sodium fluoride, the five-year report records a reduction of 59.8% in tooth decay for the five to seven-year old group, and cavities reduced 25% in the fourteen-year class, at a reported cost of 13c per annum per capita. (E.N.R., 7/26/51).

Standardized procedure has been perfected in many cities now using the process. The American Water Works Association has published a tentative recommended procedure for water fluoridation which is decidedly helpful from a practical point of view, while recognizing that the process is still in the experimental stage (Journal, A.W.W.A., July, 1949.)

### An Opinion

Water works managers, and water operators in general, have a duty to perform for their communities—to acquire and retain full up-to-date "know-how" in the process of fluoridation. Then, when public demand arises, they will be ready to proceed as worthy representatives of the profession. Surely, the possibility of the reduction of dental decay, a worthwhile hope for "Young America," is now nearing reality.

# Chlorine Handling Facilities at Richmond's Filter Plants

Safety and efficiency featured in new ton-container installation of modern design based on operating experience.

*by* H. E. LORDLEY, *Ass't. Director of Public Utilities, Richmond, Va.*

CHLORINE is a chemical so commonly employed in the treatment of water, sewage, and industrial wastes that many engineers take too casually the hazard of this toxic and destructive agent and design chlorine installations which fail to amply provide safe handling facilities. An AWWA committee on chemical hazards in water works presented a comprehensive report published in the September, 1935, issue of the AWWA Journal. The Chlorine Institute, Inc., New York, has published an excellent handbook on the properties and use of chlorine. Although the general physical and chemical properties of the element will not be discussed in this paper, in the design of equipment it is important to remember certain basic properties. First, gaseous chlorine is approximately 2½ times as heavy as air and will tend to flow to the floor and second, heat is required (123.8 Btu's per lb.) to convert liquid chlorine to gas.

With the increased requirements of chlorine for super-chlorination of water, for sewage treatment and for making chlorinated iron salts, the use of one ton chlorine containers is now common practice in many plants. Richmond installed an outdoor storage and gassing chamber for ton containers early in 1935 which operated successfully at rates as high as 4,000 lbs. of chlorine gas per day. The outdoor installation, in use until 1950, has now been superceded by an indoor installation. Design and operating details of both types are given in this paper.

## The Outdoor Installation

The outdoor installation eliminates the necessity for providing fans and ventilating systems. It has certain disadvantages in that containers are exposed to wind, rain, snow, and sun, but from our experience this has not been a serious problem. The Richmond installation was designed to handle both rail and truck delivery and includes several component parts: The storage area, the gassing chamber, and the container handling structure. The storage area consists of concrete cradles to support the ends of the tanks, and employs crushed rock as a base under the tanks. The number of storage spaces will depend on the plant requirements, availabilty of chlorine and method of delivery. In Richmond, 30 spaces were constructed, and provision was made for a double tier of tanks to accommodate a total of four carloads, each of 15 one ton containers. Full containers are stored with the valve hoods in one direction and empty containers with hoods in the opposite direction to facilitate physical inventory and loading of empty containers.

Figure 1 shows the general arrangement of the facilities with the gassing chamber in the foreground. The gassing chamber also includes provision for two one ton ammonia containers and for a one ton container of sulphur dioxide. The monorail supporting the electric hoist extends over the railroad tracks between the filter building and the chlorine storage chamber. Containers are raised and lowered by the electric hoist, but are moved from one position to another by manpower. On a few occasions during the winter months some difficulty has been encountered with ice and snow on the rails and tanks.

The gassing chamber, adjacent to the storage area, provides six spaces for chlorine tanks. The tanks rest on concrete cradles within a concrete box and are covered with folding wooden tops made from standard tongue and groove lumber. In front of each container, a sliding wooden door provides access to the tank valve and pipe manifold.

The tank connectors and valves are the same design as shown in Figure 3. The pipe manifold is divided into two sections and equipped with pressure reducing valves adjusted to deliver gas to the chlorinators at a maximum of 35 psi gage pressure.

At high gassing rates, frost will form on the containers and the rate of gas delivery will be reduced unless external heat is applied. In this installation, warm air from the heating system in the filter plant is blown through 4" terra cotta pipe located

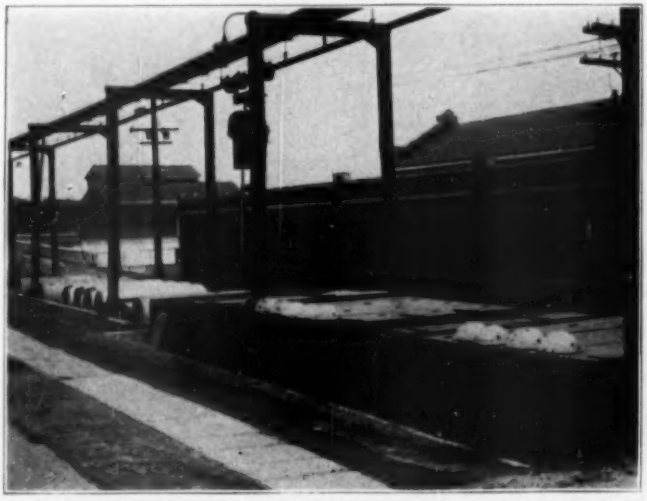


Fig. 1—OUTDOOR INSTALLATION. Chlorine container storage in background, gassing chamber in foreground.

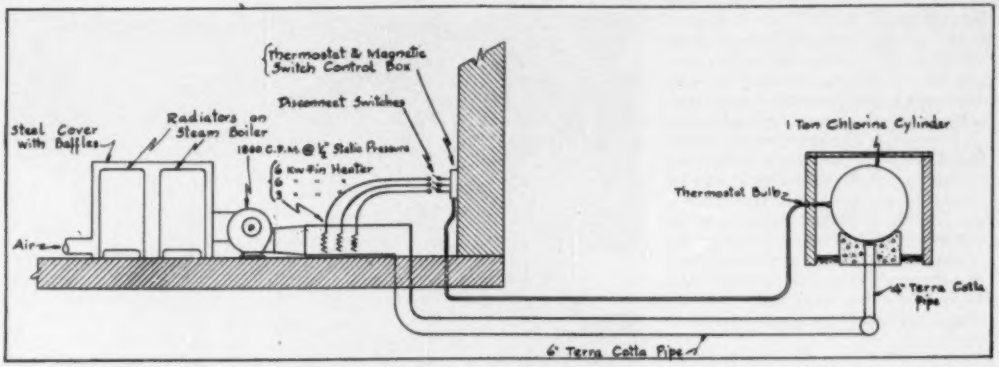



Fig. 2—HEATING SYSTEM for outdoor installation. Blower delivers air heated by steam radiators and by thermostatically controlled electric units.

under the center of each container. The warm air heating system utilizes three main elements: (1) warm air from steam radiators on the plant heating system; (2) electric fin heaters with thermostatic controls; (3) a motor operated blower as shown in Figure 2. With this system, warm air is delivered through terra cotta drain pipe to the gassing chamber and as gassing rates increase or outside temperature decreases the thermostat controls turn on additional fin heaters to maintain a temperature of approximately 70° F. Prior to the installation of this system high gassing rates during winter months were impossible and consideration was given to the use of evaporators and other possible heating systems before this system was adopted.

No provision was made for platform scales since they were expensive and difficult to maintain in outdoor installations. Scales are not required for the control of chlorine feeding. The Richmond plant has one pair of Buffalo No. 1484 Suspension Crane Scales to check all empty containers shipped. In use, the scales are connected between the hook of the chain hoist and the lifting bar of the container. Plant personnel can, however, detect empty containers by differences in the sound produced by a full and empty container when struck with a hammer. Although this sounds like a primitive method practically no chlorine is found in the empty containers marked for shipment.

Outdoor storage was discontinued at the plant in 1950 after a new purification plant was constructed and an indoor installation was provided for both the old plant and the new addition.

### The Indoor Installation

In the new plant, the chlorine gassing room is 18 feet wide by 70 feet long, with exit doors at each end. It is located on the second floor of the building. Concrete cradles support the 14 chlorine containers, four ammonia and two sulphur dioxide containers. Ventilation is provided by two separate systems. One is designed to handle major leaks and the other, a smaller system, is designed to remove chlorine released during cylinder changes.

The major system consists of a 34" by 96" automatic louver opening into the container storage area and a 30" centrifugal fan to pull air through the room from the opposite end where the louver inlet is located. This fan is rated to handle 14,000 cfm at ¼" static pressure or 12,800 cfm at 1½" static pressure and is driven by a 7.5 hp motor. Push buttons stations are located outside the gassing room to operate the fan in the event of a serious leak within the room. The fan is located outside the gassing room and exhausts air through a 24" by 35" galvanized steel duct of 22 gauge metal to the brick flue from which the air is discharged above the building.

The second centrifugal fan, driven by a ½ hp motor, is rated at 885 cfm at 1" static pressure. It is connected to the 4" by 12" gas purging duct at floor level which extends the length of the gassing room. This fan exhausts

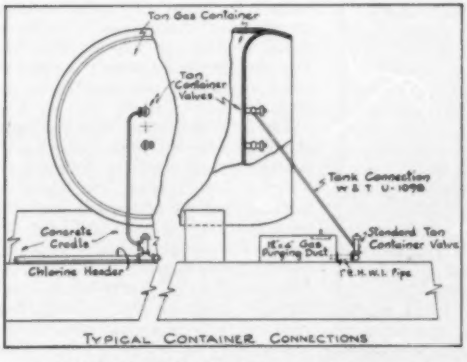



Fig. 3—CONNECTION DETAILS for one-ton chlorine containers.

Fig. 4—NEW PLANT INSTALLATION of one-ton chlorine containers.

through an 8" by 12" duct to a small brick flue which also discharges above the building. Into the duct vent opening (3" by 24") is provided at each container and is normally closed with a small metal cover except when the containers are disconnected for changing. Figure 5 shows this duct in front of the containers. This system was designed to remove small quantities of gas remaining in the connectors to the gas and manifold when cylinders are disconnected for a change. Experience has shown that this system is satisfactory, but a fan of greater capacity than that now installed would be preferable.

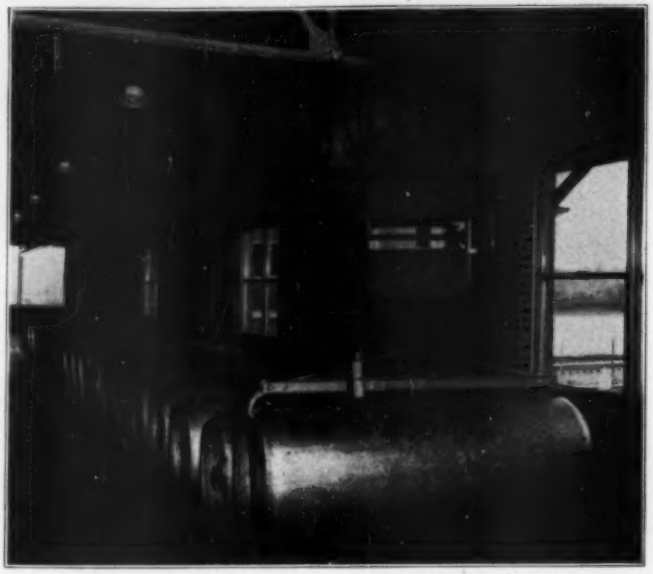


Fig. 6—HANDLING FACILITIES illustrate use of crane-scales to check container weights. Monorail extended over rail siding below.

### Heating Arrangements and Connections

The method of furnishing heat to evaporate liquid chlorine was developed after careful study of systems in other plants. In general, large users of chlorine utilize either a temperature controlled water bath around the container to gassify the chlorine directly, or use a separate unit termed an evaporator in which the liquid chlorine is gassified. The water bath maintains proper temperature on the containers, but creates maintenance, housekeeping, and safety problems which may be eliminated by the use of a warm air system.

In the Richmond plant the gassing room hot water heating coils are furnished by a separate circulator pump operating direct from the boiler and designed for the following conditions: entering water 200° F., exit water 180° F., entering air 70° F., exit air 115° F. Face area 3.0 square feet, heat load 72.8 mbh. The coils are located in a 16" by 30" duct 8 feet high with intake 2 feet from the floor and equipped with a fan of 1650 cfm discharging near the ceiling of the room. A thermostat located near the floor controls the operation of circulator pump and of electric strip heaters. At high gassing rates the hot water coils will not supply the heat demand, and electric steel fin strip heaters are installed in the same duct to provide additional heat. These units are arranged as shown in Figure 5.

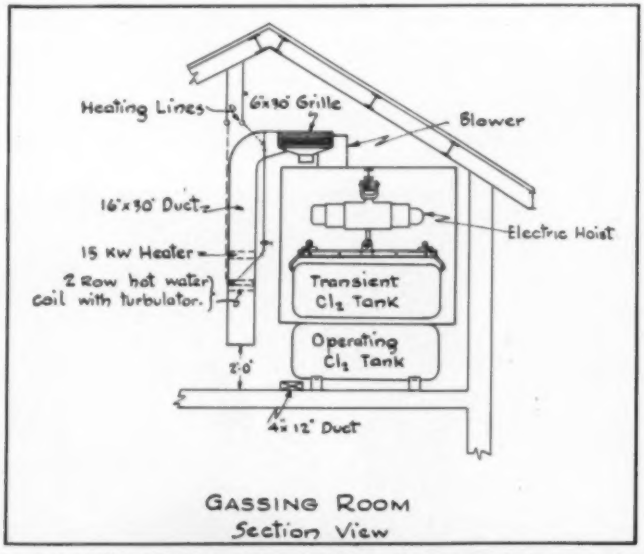



Fig. 5—HEATING SYSTEM for indoor installation. Hot water and thermo-controlled electric units maintain uniform temperature of gassing room.

The units are designed for 15 KW total load in steps, with the first step 3.0 KW, second at 6.0 KW and 3rd at 6.0 KW when operating on three phase 60 cycle, 208 volts. The strip heaters are controlled by three manually operated switches depending on the number of steps required for the gassing load. This system has operated successfully during the winter months and we believe it superior to the water tank method. Because of water drip from the sweating containers it was found necessary to water proof the floor area beneath the cylinders and grade the area to a drain in order to remove the water of condensation.

The tanks are connected to the header valves with 30" Type U-1098 tank connectors supplied by Wallace & Tiernan Co. Standard ton container chlorine valves are used, and the manifold has connections for 14 tanks. The manifold has a sectionalization valve between two groups of 7 tanks. Two 1" extra-heavy black wrought iron pipe lines extend from each end of the manifold to the chlorinator room on the floor below. Two pressure reducing valves capable of delivering 5,000 lbs. of chlorine per

day are located in each line to reduce tank pressure to 25 psi gage prior to leaving the gassing area. This reduces the hazards of leaks in the chlorine feeding room and the possibility of liquid chlorine reforming in the feed lines.

Storage space is provided for 38 one ton containers. Delivery can be made by rail or on trailer trucks. Containers are unloaded by an electrical operated hoist and trolley system from the railroad siding to the second floor. The hoist is designed to handle a net load of 4,000 lbs. with full load hoisting speed of 28 fpm and full load traveling speed of 150 fpm. Figure 6 shows the equipment including the Buffalo Scales used to check tank weights. In moving containers to the gassing chamber, or to storage, the crane-scales are removed and stored at the end of the room. Swinging doors between the container storage and gassing rooms are opened by the container in transit from one area to the other.

Gas-masks are provided at various locations outside the gassing room and are inspected at regular intervals. We have been fortunate in having only minor leaks since the installation of ton containers in the early 30's. One rather unusual leak was discovered by an operator on a hot day several years ago. A ton container actually had a small hole in the steel plate on the side of the cylinder and it was necessary to patch the hole with a rubber pad and metal hoop around the cylinder. We are also fortunate in having our chlorine supplier only a short distance away to render assistance in case of emergency.

This discussion has covered the design of handling equipment, but still more important is the routine maintenance schedule which every plant operator should establish. A small chlorine leak can cause more damage in a few days than any other operation in the plant, so *never delay maintenance on your chlorine equipment.*

# Fla. Section AWWA & Fla. Sewage Wks. Assn. Hold Joint Meeting*

More than 200 water, sewage and industrial waste plant operators gathered in Daytona Beach, Fla., for a four day joint meeting of the Florida Section of the Am. Water Works Assn. and the Florida Sewage and Industrial Wastes Assn.

"Because the two groups have so many problems in common from a health and sanitation standpoint, it was decided to continue joint meetings of the two associations," stated Sidney W. Wells, chairman of the water-works group.

Despite steel and copper shortages, the water, sewage and industrial wastes industries have apparently been able to maintain their plants and carry on all essential expansion.

T. T. Quigley, Belleville, N.J., had fairly good news for the delegates when he declared: "Without a full-scale shooting war, the future looks no worse than now. While the Controlled Materials Plan (CMP), operated by the Water Resources Div. of NPA, is a nuisance, it's the best method so far to take care of the problems of shortages. Fortunately, the people of that Division are mostly water and sewage men who understand the problems of these services and are sympathetic. The degree of urgency and necessity for public health protection is a top criteria in determining allocation of controlled materials."

Papers on the cathodic method of rust prevention were read by two Univ. of Fla. chemistry professors, Dr. Armin H. Grogg, and Al Himmel, and Frank P. MacDonald, sales manager for Electro Rust-Proofing Corp., Belleville, N.J.

All pointed out the tremendous progress in refining and developing the method to a point where it is effective in practically every situation if properly engineered.

The new elevated tank to be installed in Port Orange by Marvin Boyce Co., Clearwater contractors, will have cathodic protection. Mr. Boyce, who is secretary of the Fla. Section, explained how by reversing the natural flow of galvanic electric current through the water onto the metal, corrosion is eliminated.

"A new toy 15 years ago," he said, "the cathodic method of protection has become increasingly effective and is now used in many of the Florida water plants."

Florida Industry has spent more than $50,000,000 on stream pollution abatement programs in the past five years. The State Board of Health's Chief Engineer, David B. Lee of Jacksonville, described the State's approach to stream pollution abatement as "realistic."

"The problem is fourfold," he said, "to be considered are public health, public recreation, economic value of land touched by polluted streams and esthetics. Industry, as a whole, has cooperated with the State Health Dept. in the problem, and new industries consult the Department first for advice on proper location. Florida's pollution control laws were passed in 1927."

Harvey Howe, director of the Water Resource Division of the National Production Authority, Washington, D.C., told how construction materials will be allocated in the present defense preparedness program.

Other speakers were Harold A. Scott of the U.S. Engineering Dept., Jacksonville, speaking on the distribution of water in the Central and Southern Florida flood control project. Col. A. G. Matthews of Tallahassee, chief engineer for the Division of Water Survey and Research, led a panel discussion on "The Reaction of Flood Control." W. R. Clary of Bartow, sanitary engineer for the Florida State Board of Health directed a study of pollution conditions on the Peace and Alafia River watersheds. Ralph Fuhrman, superintendent of the Washington, D.C., sewage treatment plant and immediate past president of the Federation of Sewage and Industrial Wastes Assns., discussed maintenance of sewage treatment plants. Mason S. Nagel, superintendent of the Orlando Sewage Treatment Plant spoke on "One Year's Operation of the Orlando Biofiltration Sewage Treatment Plant."

Ralph F. Brennan, Daytona's water superintendent for 14 years, was unanimously elected chairman of the Fla. Section of A.W.W.A., succeeding Sidney W. Wells, Jacksonville.

John E. Kiker, Jr., professor of sanitary engineering at the U. of Florida was elected president of the Florida Sewage and Industrial Wastes Assn. John W. Wakefield, Jacksonville, sanitary engineer for the State Board of Health was named vice president; Perry M. Peeple, also of the State Board of Health, was re-elected secretary-treasurer. J. R. Hoy, Florida representative for the Wallace Tierman Co., makers of Chlorination equipment, was named as a national director of the organization.

Outgoing president is Walter J. Parks, Jr., Jacksonville, Cons. Sanitary Engineer of Jacksonville.

(*Continued on page* 90A)

* A report by Henry C. Suter, Daytona Beach, Fla.

# Iron Removal Practices with Illinois Ground Waters

*by* KENNETH E. COWSER, *San. Engr., East Central Region, Ill. Dept. of Health, Champaign, Ill.*

APPROXIMATELY 536 public and institutional ground water supplies exist in the State of Illinois. The iron content in these supplies ranges from 0.0 to 30.1 ppm. (at Prairie du Rocher). Iron as it exists in natural ground water is in the soluble (ferrous) state. It has been reported[1] that 116 plants practice iron removal. The accompanying table shows the number of plants, iron concentration and number with iron removal treatment.

IRON REMOVAL DATA ON ILLINOIS GROUND WATER SUPPLIES

| Iron Content ppm. | No. of Supplies | % of Total Supplies | Supplies with Iron Removal No. | Removal % |
|---|---|---|---|---|
| 0.0 to 0.4 | 188 | 35 | 0 | 0 |
| 0.4 to 1.0 | 134 | 25 | 24 | 21 |
| 1.0 to 2.0 | 107 | 20 | 35 | 30 |
| 2.0 to 5.0 | 80 | 15 | 41 | 35 |
| Over 5.0 | 27 | 5 | 16 | 14 |
| Total | 536 | 100 | 116 | 100 |

## Methods of Treatment

There are seven methods employed for the elimination of iron or iron difficulties from groundwaters, which have been approved by the Illinois Department of Public Health:

### Coke Tray Aeration, Retention and Filtration

Water is passed through coke or rock filled trays for aeration, provided a retention period, and then filtered. A flow rate of 3.0 gpm, per sq. ft. is considered a maximum through coke or rock trays. A minimum retention period of 60 minutes based on minimum water levels in the retention tank is required. (The maximum allowable rate of flow through pressure filters is 3.0 gpm. per sq. ft. for sand and anthracite filter media; the same gravity filtration rate for sand filters handling groundwaters is approved. A filter backwash rate of 15 and 10 to 12 gpm. per sq. ft. for sand and anthracite respectively, are acceptable for design.)

It is interesting to note that this method of iron removal is the one most generally employed in the State, and has proved effective in the removal of iron normally below 0.2 ppm.

### Contact Filters

There are two general types of contact filters, employing either[(1)] gravity filtration with forced air through the filter medium or[(2)] gravity filtration with removal of gases from the filter by suction. Water is applied with a free fall discharge to the filter medium or water surface, depending on the head loss through the filter, by either a rotary or fixed distributor. Anthracite varying from 3/32 to 3/16 inch in size is used as the filter medium, with approved rates of flow from 6 to 10 gpm. per sq. ft. In the first arrangement, forced air at a rate of 1.0 cfm, per sq. ft. of filter area is applied in one case to the interstices of the filter medium by means of an air-grid system. Apparently a scrubbing action is provided by the air to scavenge carbon dioxide from the filter. In the second arrangement, the suction method employs use of an air compressor or fan of similar design rate to take suction from a space beneath a false bottom supporting the filter medium. As the water trickles through the medium, gases are liberated and are picked up by the suction when water reaches the lower stages of the filter. An air backwash is used to supplement the normal water backwashing. Beneficial catalytical effects[2] are received from the previously formed iron oxides in the bed, similar to that encountered in coke aerators.

A forced air installation at Fisher, Ill., was installed with a design rate of flow of 6.4 gpm. per sq. ft. while an air suction unit was recently installed at Cullom at a design rate of 8.0 gpm. per sq. ft. The plant at Fisher has shown a reduction of iron from 1.7 ppm. in the raw water to an average of 0.2 ppm. in the final effluent.

### Pressure Aeration

Pressure aeration consists of the introduction of compressed air through a porous diffusor to the discharge side of the well pumps. This process, as the name implies, is conducted under normal operating pressures, and allows but several seconds contact time of water and oxygen prior to reaching the pressure filters. Thorough mixing of oxygen and water is then necessitated by the porous diffusor, while excess gases are bled off through an automatic gas relief valve located off the top of the filter shells. Normal design indicates the use of a ⅓ hp. air compressor to aerate 100 gpm. Plants in operation at Fairmount and Onarga, Ill., are designed to handle 70 gpm. and 150 gpm. respectively. They are reducing a raw water iron content from 7.2 ppm. and 2.0 ppm. respectively to an average of .28 ppm. and .04 ppm. respectively. The oldest of the two units has been in operation less than a year.

### Base Exchange

It is the accepted rule in Illinois that a raw water having less than 1.0 ppm. of iron could employ the base exchange properties of zeolite material for removal of iron. Normally, the hard water bypass is set at 20 to 25 per cent which upon blending with the softened water would theoretically provide a plant effluent with 0.20 ppm. to 0.25 ppm. iron. Experience has indicated[3] that an iron bearing water, in excess of 0.50 to 0.60 ppm. or iron, would tend to shorten the life expectancy of the zeolites due to the mechanical action of filtering out iron in a ferric state. This mechanical filtration action and life shortening is not selective to the varied types of zeolite materials. It was generally accepted that greensand zeolite would be employed as it was not impaired so rapid-

ly as the silica gel; this selection was used prior to the development of the newer synthetic zeolites. Applebaum and Bretschger[4] indicated that the normal salt regeneration is sufficient to remove iron from the zeolite. Five supplies, picked at random, that are practicing iron removal by this method have raw water iron contents ranging from 0.20 ppm. to 1.3 ppm. with final plant effluents averaging 0 to 0.19 ppm. of iron. The rate of flow through the units depend upon the type of zeolite employed, ranging from 4.0 gpm. per sq. ft. for the greensands to 8.0 gpm. per sq. ft. for the synthetic zeolites.

### Catalysis Materials

A commercially prepared material known as Birm, (assumedly a manganese material), was initially installed in pressure filters at three plants in the State. Since installation one plant has been revamped, one eliminated, and one continues in operation. The material is used to remove iron from water catalytically and does not require regeneration but rather simple backwashing as employed with a sand filter. It is necessary, however, to have dissolved oxygen in the water sufficient to combine with the iron to effect its removal. The design is similar to that for sand pressure filtration. At Durand, Ill., the raw water contains 0.3 ppm. of iron, and following treatment the recent average iron content was 0.3 ppm. It is believed that the material generally has no advantages over sand filtration when aeration is necessary.

### Lime Softening

In the process of water softening by lime treatment, iron removal may be considered incidental. However, it undoubtedly is one of the most efficient methods for iron removal in use. Of 14 supplies practicing lime softening, iron in the raw water varied from .1 to 4.3 ppm. with an average of 2.0 ppm.; the finished waters normally have less than 0.1 ppm. of iron. The plants generally provide for aeration to reduce the amount of lime necessary to attain the desired end results.

### Sequestration

Although the use of sequestering compounds can not be considered a method of iron removal, Rockford has employed the feeding of hexa-metaphosphate compound direct to the wells in an effort to prevent precipitation of iron in the distribution system. The iron content of the raw water averages .45 ppm. Authorities have reported variable results in so far as elimination of iron staining problems at this supply. About February, 1951, the Rossville plant initiated iron sequestering by use of a higher valent polyphosphate (7 atoms of phosphate). The raw water iron content approximates 2.9 ppm., and thus far control has called for 4.0 to 6.0 ppm. of the polyphosphate. The rule of thumb used for determining the dosage necessary is application of 2.0 ppm. of polyphosphate for every 1.0 ppm. of iron. As this supply is in the early stages of such treatment, conclusive results are not available; however, present report indicates a marked reduction of fixture staining and the expression of favorable public opinion. A chlorine residual of at least 10 ppm. is required in the stock solution of polyphosphate to be fed, by the State authorities. This is deemed necessary as the solution is a good media for bacterial growth unless maintained sterile.

### General Observations

Fortunately most Illinois waters take standard iron removal practices favorably, with production of satisfactory plant effluents. Where iron removal is not too below the desirable limit, lack of proper maintenance of equipment may normally be indicated. However, there are cases where efficiencies are quite variable due to treatment problems encountered. One example is at the Morton plant where coke tray aeration, retention, and pressure filtration is practiced. It has been found that a slime growth has developed in the reaction basin and apparently follows through to the filters. While a satisfactory D.O. content is available in the reaction basin, the filter effluent is void of D.O. which is unnatural for this type treatment. Technical personnel of the Health Department believe that ferrous iron is being converted to ferric iron by aeration, but upon being pumped through the filters the excess D.O. is being absorbed and a reduction of ferric iron is occuring due to the slime growths. The use of controlled copper sulphate feed to the recation basin is being employed to combat the slime growths.

There are no supplies in the State which use chlorination exclusively for oxidation of iron. Many supplies chlorinate for disenfection purposes. At the present time the manganous zeolites which require regeneration with potassium permanganate are not accepted by the Health Department, for iron removal from public supplies.

When water is treated for iron removal, the stability of the water is effected. Especially in plants that employ aeration of one form or another, a corrosive water tends to be produced unless corrective treatment measures are applied. This is born out by the increased iron contents found in distribution systems, above that encountered in the plant effluents. An alkali solution consisting of caustic soda and caustic silicate, is fed by positive type feeders to reduce the water's aggressiveness.

### References

1. Circular #31, State Water Survey Division, Urbana, Illinois
2. G. E. Hauer, Iron and Carbon Dioxide Removal. Jour. A.W.W.A. Vol. 42, No. 6, June 1950
3. Technical Personnel, Division of Sanitary Engineering, State Health Department, Springfield, Illinois
4. S. B. Applebaum and M. E. Bretschger, Indus. and Eng. Chem. V 26, N 9, Sept. 1934.

## R. R. Yard Waste Treated

The waste treatment system recently installed at the Enola, Pa., yards of the Pennsylvania Railroad Co., to abate pollution of the Susquehanna River was built at a cost of $442,000 to eliminate the pollution by oil which for a long time had caused many complaints from residents along the river.

The treatment works is designed to treat 2 mgd. of wastes and sewage from the yards. The wastes contain much oil which comes from the various yard operations, including the washing of locomotives.

The wastes are directed to the treatment plant through an interceptor. At the plant the wastes pass through a grit chamber where solids are settled out and much of the oil is skimmed off. The effluent is then chemically treated and passes through a floculation tank and then to a settling tank measuring 18 by 19 feet and eight feet deep, having a capacity of 195,000 gallons. The clear effluent goes to the river. The solids, including cinders and the oil are pumped to lagoons measuring 570 by 320 feet, 15 feet deep, having a capacity of 183,000 cubic feet.

**Americana and World Leadership**

The greatest Country in the world is this United States of America. Occupying but 7% of the earth's surface, and with but 6% of the globe's population, the U.S. is now producing 50% of the world's wealth. With this goes the great responsibility of world leadership.

# St. Paul Is Host to Federation

## 24th Meeting Features Water Policy and Controlled Materials

A Report by

GEORGE E. SYMONS*, *Contributing Editor and* HARRY A. FABER**, *Editorial Associate, Water & Sewage Works, New York City.*

STATELY St. Paul, gateway to Minnesota's lakeland and metropolis of the Upper Mississippi, served as the setting for the 24th annual meeting of the Federation of Sewage and Industrial Wastes Assns. on Oct. 7-11.

Welcomed by the Honorable Edward K. Delaney, Mayor of St. Paul, some 715 registrants participated in or listened to a timely and diversified technical program supplemented by an informative inspection trip and a social program which fostered fellowship and friendliness.

Acting as host association, the Central States Sew. & Ind. Wastes Assn. held a Smorgasbord and business session open to all registrants. Responsibilities for local arrangements were entrusted to a committee of some forty persons, headed by Kerwin L. Mick, Chief Engr. and Supt. of the Minneapolis-St. Paul San. Dist.

**Vice-President**
*E. Sherman Chase*
*Cons. Engr.*
*Boston, Mass.*

**Treasurer**
*W. W. DeBerard*
*City Engineer*
*Chicago, Ill.*

In addition to the technical sessions, which were held at the Municipal Auditorium, registrants had the opportunity to view the latest sewage works equipment as displayed by 28 manufacturers who were exhibiting.

### New Federation Officers

At the annual meeting of the election committee of the Federation, consisting of the directors representing Member Association, the following slate of officers was elected to serve for the ensuing year.

**Presidents**

**Retiring**
*Ralph E. Fuhrman*
*Supt., Sewage Treatment Wks.*
*Washington, D.C.*

**Incoming**
*Earnest Boyce*
*Prof. San. Eng.*
*Univ. Michigan*
*Ann Arbor, Mich.*

*President*
Earnest Boyce, Prof.
Munic. & San. Engng.
University of Michigan
Ann Arbor, Mich.

*Vice President*
E. Sherman Chase, Partner
Metcalf & Eddy, Cons. Engrs.
Boston, Mass.

*Treasurer*
W. W. DeBerard, City Engr.
Dept. of Public Works
Chicago, Ill.

*Exec. Secy.-Editor*
W. H. Wisely
Champaign, Ill.

Dr. F. W. Mohlman, Div. of Labs., San. Dist. of Chicago was continued as Advisory Editor of the Journal.

Elected to fill one of the Directorships at Large was R. G. Tyler, Prof. of Civil Engineering, at the University of Washington.

### Honors and Awards

There being no vacancies in the ten honorary memberships, there was no recommendation for any additional honorary members.

At the annual banquet, honors and awards were presented to members whose work or service had been considered as deserving of recognition.

The PAST PRESIDENT'S CERTIFICATE went to *Arthur H. Niles*, who was president of the Federation in 1949, and who is Supt. and Engr., Sewage Treatment Works, Toledo, Ohio.

The HARRISON PRESCOTT EDDY MEDAL for "An Outstanding Contribution to Research" was presented in absentia to *Peter S. S. Dawson*, and *Samuel H. Jenkins*, Chemist, Birmingham, Tame, and Rea Drainage Bd., Birmingham, Eng., for their paper, "The Oxygen Requirements of Activated Sludge Determined by Manometric Methods—II. Chemical Factors Affecting Oxygen Uptake," which appeared in *Sew. & Ind. Wastes* in April, 1950.

The GEORGE BRADLEY GASCOIGN MEDAL for "An Outstanding Contribution in Plant Operation" was presented to *Leonard S. Hillis* for two papers; "Solving a Digester Scum Problem" and "Recirculation of Final Effluent in a Small Activated Sludge Plant," both of which appeared in the 1950 Journal.

**Exec. Sec'y**
*W. Homer Wisely*
*Headquarters*
*Champaign, Ill.*

**Ass't. Sec'y**
*H. P. Orland*
*Headquarters*
*Champaign, Ill.*

The CHARLES ALVA EMERSON MEDAL for "Meritorious Service to the Federation" was presented to *Howard Eugene Moses*, Cons. Chief, Engr., Penna. State Dept. of Health, "who has for many years contributed outstanding and praiseworthy service to the Federation."

The INDUSTRIAL WASTES AWARD for "An Outstanding Contribution in Industrial Wastes Control" was presented to *Bruce W. Dickerson*, for his paper on "High-Rate Trickling Filter Operation on Formaldehyde Wastes" published in the April 1950 issue of the Journal.

The WILLIAM D. HATFIELD AWARDS for "Outstanding Operation Reports" were presented in three categories. In Group I, communities of less than 10,000 population, a "Previous Winners Award" went to *W. L. Edwards*, Supt., Sewage Treatment,

*Consultant and Technical Editor, Larchmont, N. Y.
**Res. Chem., The Chlorine Inst., New York City.

*M. L. Robins*
*Chief Chemist*
*Minn.-St. Paul Distr.*
*Minneapolis*
**(President)**

*H. T. Rudgal*
*V.P. and Mgr.*
*Hobart Water Corp.*
*Gary, Ind.*
**(Past-Pres.)**

*W. D. Hatfield*
*Supt. and Engr.*
*Sanitary Distr.*
*Decatur, Ill.*
**(Fed. Director)**

*Paul Troempfer*
*San. Engr.*
*Ill. Dept. Hlth.*
*Springfield, Ill.*
**(Secy.-Treas.)**

**Central States Ass'n Officers**

Gowanda State Hospital, Gowanda, N.Y.

In Group II, communities of 10,000 to 100,000 population, an original award went to *E. J. Meers*, Chemist, Sanitary District, Danville, Ill.; in the same group a previous winner's award went to *John R. Szymanski*, Supt., New Britain, Conn.

In Group III for populations of more than 100,000, an original award went to *George H. Craemer*, Supt., Sewage Treatment Works, Hartford, Conn.; in the same group, a previous winner award went to *Kerwin L. Mick*, Chief Engr. and Supt., Minneapolis-St. Paul Sanit. Dist.

Announcement was made of the selections for the ARTHUR SYDNEY BEDELL AWARDS. These awards are made by the Federation to those persons selected by individual associations in recognition of service to that association. These certificates will be presented at the annual meeting of these associations: Arizona—Harold W. Yost, Alabama—John Clinton Clarke, Florida—John Robertson Hoy, Kansas—Roy Binder, Ohio—Arthur H. Niles, Pennsylvania—John Raymond Hoffert, Inst. Sew. Engr.—Charles Henry Trusler, Missouri—Francis M. Veatch.

### Board Actions

Business of the Federation is carried on by a Board of Directors, which meets on Sunday before the technical session begins, and again on Thursday after the technical sessions are over. Many of the committee reports and actions taken at the Board Meeting are of general interest.

Secretary Wisely reported that although advertising pages in the Journal had increased from 393 to 425 for 1951, the cost per page for printing the Journal had increased from $15.43 in 1950 to $18.35 in 1951. Total paid circulation of the Journal was 6013 of which 5764 were membership. This represented a gain in circulation of 3.1 per cent.

There were 32 member association meetings in the year past, and Federation officers visited 26 of these meetings.—Membership in the member associations showed an increase of 96 or 1.9 per cent. Eighteen associations showed increases totalling 247, but nineteen associations showed losses totalling 151. The loss of 33 members in the Inst. Sew. Purif. in England was offset by the addition of the German Association with 34 members.

The numerical increase contest was won by Michigan with a gain of 34 members; California was second with 33 new members, followed by New England with 29, New Jersey with 27, and Canada with 19. Biggest loss was in the I.S.P. with 33, followed by Pennsylvania with 25, and Federal with 21.

The percentage increase contest was won by the Inst. of San. Engrs. in England with a gain of 57 per cent, followed by Kansas with 28 per cent and Alabama with 24 per cent. One of the Board Members pointed out that some of these associations which had won previously and had since lost a goodly number could win again by signing up those members which had dropped out.

With the publication of Manual of Practice No. 4, titled "Chlorination of Sewage and Industrial Wastes," and the purchase of a number of reprints of the Joint Committee Report on "Fundamental Considerations in Rates and Rate Structures for Water and Sewage Works," the Publication Revolving Fund of the Federation now has nine items in it. Several of these items, particularly, M.O.P. No. 1, the Accounting Manual and The 20-Year Index, have showed a profit. M.O.P. No. 4 having only been published within recent months, had almost paid for its publication costs. Slowest movers were the Glossary and the M.O.P. No. 2. The Revolving Fund Balance is now $3,140.75 and the actual cost-book value of the inventory on hand is $4,797.35, a very healthy situation.

The general financial situation of the Federation continued to improve and by the end of the year the net worth is expected to be more than $60,000 an increase of some $3000 in the past year. This report indicates that the management of the Secretary's office and the affairs of the Federation continue to be handled in an exemplary manner. The Board taking cognizance of this fact voted to extend Mr. Wisely's tenure as Secretary through 1956.

During the discussion of the Publications Committee Report, it was pointed out that the conflict between two concurrent sessions at annual meetings (Operators Forum and Industrial Wastes Forum) had created considerable criticism. It was the sense of the meeting that this conflict should be avoided in the future and the suggestion was made to eliminate scheduled inspection trips on Wednesday afternoons of the meeting and to move one of the Forums to that time. It is expected that some such arrangement will be tried at the meeting in New York City in 1952.

It was also decided that the Federation would publish a membership list only in alternate years and that such a list would contain not only a complete alphabetical listing of the membership, but also a geographical listing by name only. The details of how this will be worked were left to the

*H. E. Moses*
*Cons. Chief Engr.*
*Pa. Dept. Hlth.*
*Harrisburg, Pa.*
**(Emerson Medal)**

*B. W. Dickerson*
*San. Engr.*
*Hercules Pwd. Co.*
*Wilmington, Del.*
**(Ind. Wastes Award)**

*L. S. Hillis*
*Supt. Treatment*
*State Hospital*
*Warren, Mich.*
**(Gascoigne Medal)**

*N. E. Anderson*
*Design Engr.*
*Chic. San. Distr.*
*Chicago, Ill.*
**(Rudolphs Award)**

**Awardees**

**Hosts and Local Chairmen**

*Kerwin L. Mick*
*Chief Engr.*
*Minn.-St. Paul Distr.*
*St. Paul, Minn.*
**(Arrangements)**

*Geo. Schroepfer*
*Prof. San. Engr.*
*Univ. Minnesota*
*St. Paul, Minn.*
**(Host Comm.)**

*L. J. Bartscher*
*Minn.-St. Paul*
*San. Distr.*
*St. Paul, Minn.*
**(Hotels)**

*W. H. Cropsey*
*Supt.*
*Treatment Whs.*
*So. St. Paul, Minn.*
**(Insp. Trip)**

Secretary's Office and the Publication Committee.

The Research Committee reported that the annual review of literature had entered its eighteenth year of publication. During that period the number of papers reviewed increased from 122 for the two year period of 1932-33 to 661 papers in 1950. In 1950, out of 525 papers, 34 per cent dealt with sewage, 46 per cent dealt with industrial wastes, and 20 per cent dealt with stream pollution. There were 95 papers dealing with analytical methods, showing the heavy interest in this subject.

With the publication of Manual of Practice No. 4 on Chlorination, attention can now be turned to the issuance of M.O.P. No. 5 on Air Diffusion. This can be expected some time in the coming year, inasmuch as the manuscript is now in Secretary Wisely's office ready for preparation for the printer. Six other Manuals of Practice are in some stage of development by special subcommittees of the Committee on Sewage and Industrial Wastes Practice.

As indicated above, a German Sewage Works Assn. affiliated with the Federation during the past year and a Swedish Association is now considering affiliation. The Board suspended the Argentina Association until such time as it can be reactivated with the approval of the government of that country.

The Standards Methods Committee under Dr. W. D. Hatfield reported that the manuscript for Part II of Standard Methods was now in the hands of his committee for review and revision. It is expected that the 10th Edition will be published some time in 1952.

While the Federation wants to be informed as to legislative action current in the several states, its committee is not to be charged with a compilation of such information in the future. Data collected by Russell Winget of the Committee showed that during the past year there were 90 bills introduced in 33 states. Of these 16 passed. Committee Chairman David B. Lee submitted an addendum to the report and called attention to a study by a group of Public Health Service Personnel. This group had determined that fifty areas needed added sewage works facilities as a result of the defense program, either directly because of military areas or because of industrial expansion. These areas need additional facilities to the extent of $125,000,000. Of this amount $26,161,000 is for new sewage works and their maintenance and operation.

The Joint Committee on Critical Materials having helped in the formation of the Water Resources Division of the N.P.A., its work was considered completed and it was discharged. The Special Committee on Chlorine Supply was continued in the form of participation in the Joint Committee on Chlorine Supply consisting of AWWA, FSIWA, Public Health Service, and Conference of State Sanitary Engineers. In general, the conditions which brought the Federation Committee into being a year ago have been relieved, largely by the N.P.A. Order M-31 which was issued last February.

The budget adopted for 1952 is $81,600 an increase of $4600 over 1951. The incoming board also picked the meeting place for the 1954 meeting as Cincinnati. (The 25th-Silver Anniversary 1952 meeting is scheduled for Hotel Statler in New York; the 1953 meeting is scheduled for Miami, Fla.) Other invitations for future meetings include Texas, California, and New Jersey (Atlantic City).

### Central States Meeting

During the course of the convention, the Central States Sewage and Industrial Wastes Assn. held its annual meeting and election. Officers elected for the next year include:

*President*—Maurice L. Robbins, Chief Chem., Minneapolis-St. Paul San. District, Minneapolis, Minn.

*First Vice President*—W. W. Matthews, Supt., Sewage Works, Gary, Ind.

*Second Vice President*—Emanuel Hurwitz, Prin. San. Chem., Sanitary District of Chicago.

*Third Vice President*—O. J. Muegge, Chief San. Engr., State Bd. of Health, Madison, Wis.

*Secretary-Treasurer*—A. Paul Troemper, Prin. San. Engr., Ill. Dept. of Health, Springfield, Ill.

Director to the Federation—Dr. W. D. Hatfield, Supt. San. Dist. of Decatur, Ill.

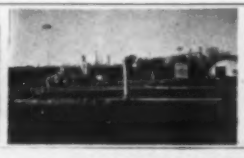
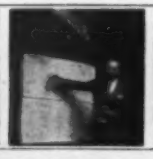
The Central States Association showed a slight loss in membership, but its financial position improved during the year.

The Gus H. Radebaugh Award for the most meritorious paper was made to *Norval E. Anderson*, Engr. of Tr. Plant Design, Sanitary District of Chicago, for his paper on "Tests on Activated Sludge Aeration."

### Luncheon Speakers

The Quarter Century Operators Club held its 10th reunion at the annual Federation luncheon. Ten of the 43 members were present.

At the annual Federation Luncheon, a surprise speaker was presented to the Federation. He was Dr. A. E.

**Inspection of South St. Paul Packinghouse Waste Treatment Plant**

*Fertilizer sludge drying plant is seen across trickling filters which are subject to backwashing. In center Fred Nelson of Dorr Co. is discussing experimental corn canning waste treatment. On right Klegerman of Alex. Potter Engrs. is explaining layout of St. Paul-Minneapolis plant to visitor from Israel.*

**Inspection of Twin-Cities Treatment Works**

*The Minneapolis-St. Paul Sanitary Distr. has something to be really proud of in this attractive, efficient, well operated and maintained plant providing low cost but ample treatment.*

BERRY, President of the Amer. Water Works Assn., who brought greetings from the AWWA and commented on the joint interests of the two organizations. Dr. Berry, who is Director of San. Engineering of the Ontario Ministry of Health in Toronto is the only man who had been president of both the Federation of Sewage Works Assns. and of the Amer. Wat. Wks. Assn. Dr. Berry is a Canadian.

The scheduled speaker for the Annual Luncheon was L. A. DANSE, Supervisor, Materials and Processes, Production Engineering Section, General Motors Corp., Detroit, Mich. Mr. Danse is the Industry Representative on the Federal Water Pollution Control Advisory Board which operates under Pub. law 845.

In speaking on "Industry's Investment in Pollution Control," Mr. Danse asked two questions—"How did we get that way?" and "Why did we get that way?" and answered by saying that industry is not altruistic; it must have customers, it must have money from customers, and if it didn't there wouldn't be much in the way of modern life for any of us. Because GM is big and is doing big things, it attracted attention. Therefore the public had to be told what the corporation was doing to be a good neighbor. As a result of this work, Mr. Danse became known in our industry as well as to the public and his appointment to the FWPCAB was recommended by many sewage works men. Mr. Danse told the audience about the work of GM, how big they really are and how competitive the individual divisions are. Thus, Mr. Danse was speaking about industry in general using Gen. Motors as an example. The importance of industrial waste treatment to operations of industry large and small was pointed out and pointed up by some other pertinent examples.

It is because industry is selfish (as are all individuals) that they have an investment in waste treatment. Partly by virtue of the necessity of having waste treatment incorporated into processing in order to use certain locations, and partly by virtue of the desire to be good neighbors and make the customers have friendly feelings toward them, industry should participate in stream pollution control and abatement.

Mr. Danse commented on the work of the Industrial Wastes Task Committees and the accomplishment to date of those committees. He also commented on the work of L. F. Warrick in connection with these Task Committees and how important his work is to making P. L. 845 function, in spite of the fact that Congress has been picayunish in the matter of funds for the operation of P.L. 845.

**Honored Guest**

*A. E. Berry*
*Ontario's Chief San. Engr.*
*Toronto.*
*Pres. A.W.W.A. and Past Pres. F.S.I.W.A.*

**First President**

*Chas. A. Emerson*
*Havens & Emerson*
*Cons. Engrs.*
*New York.*
*F.S.I.W.A.'s First President*

### Inspection Trip

The inspection trip included two plants: South Saint Paul and the Minneapolis-St. Paul San. Dist. The former constructed for a flow of 10 mgd. is essentially an industrial waste treatment plant inasmuch as only ten per cent of its flow comes from the city of South Saint Paul; the remainder of the flow is from the packing plants of Swift & Co., Armour & Co. and several smaller packing plants.

The plant consists of grit chambers, clarifiers, trickling filters, final clarifiers. Sludge and grit (which is mostly paunch manure) is ejected to lagoons and low land around the plant. At regular intervals, the trickling filters are backwashed, a practice which is not at all common.

Analytical data indicate that during the "killing days" at the packing plants, i.e. Mondays through Saturdays, the sewage is about three times as strong as on Sundays and holidays, but even on these latter days, the sewage is still stronger than normal domestic sewage due to cleanups at the plants. Whereas the population of South Saint Paul is only 16,000, the population equivalent of the raw sewage is approximately 574,000.

The following table shows some of the interesting data on the plant:

| | Susp. Sol. | B.O.D. |
|---|---|---|
| Killing Days | | |
| Raw Sewage | 792 ppm. | 1131 ppm. |
| Effluent | 88 " | 340 " |
| Removal | 88.8% | 69.8% |
| Sundays and Holidays | | |
| Raw Sewage | 225 ppm. | 371 ppm. |
| Effluent | 54 " | 109 " |
| Removal | 76% | 70.6% |

It is interesting to note that on Sundays and holidays, when the waste is relatively weak, the per cent removal of B.O.D. is approximately the same as when the sewage is strong.

The Minneapolis-St. Paul San. Dist. Plant is one of the show places of the country. In operation since 1938, this plant which treats 120 mgd. is not only an architectural delight but its performance has been outstanding under its Chief Engineers; J. A. Childs, G. J. Scroepfer, and Kerwin Mick.

The plant consists of screen and grit chambers, flocculating and settling tanks, and sludge disposal equipment. The sludge disposal equipment consists of concentration tanks for the raw primary sludge, vacuum filters, and incinerators. With this treatment, approximately 75 per cent of the suspended solids are removed (it was designed for 56 per cent removal). If and when unusually low river conditions occur, chemical treatment can be used to increase the removal of suspended solids.

### Entertainment

Entertainment features included a "Family Night" variety and vaudeville show, a Smorgasbord, and the banquet and dance for the men and ladies. For the ladies alone there was a "Get-Acquainted" Tea Party, a motor tour of St. Paul, Minneapolis, the nearby lake country, historic Fort Snelling, and Sibley Tea House with its pre-Revolutionary museum. Also for the ladies, there was a visit to the Betty Crocker Kitchen, the famous testing kitchen of General Mills

Corp. This visit was followed by a Dutch Treat luncheon and style show in the Sky Room of Dayton's Department Store in downtown Minneapolis.

### Water Resources Policy

"NATIONAL WATER RESOURCES POLICY AND STREAM POLLUTION" by Louis R. Howson, Partner, Alvord, Burdick and Howson, Cons. Engrs., Chicago, Ill.

In presenting his comments on the subject, Mr. Howson asked four questions and gave explanatory answers.

Question 1—How serious is stream pollution? It is apparent, according to Mr. Howson that not all streams in the country are affected by pollution, but certainly the major streams are so affected. Furthermore, pollution does or will affect all water uses.

In spite of the calamity howlers who cry that pollution is wrecking the country and making our drinking water unfit for consumption, there has been a definite and marked growth of sewage treatment facilities. For example, as Mr. Howson pointed out the increase in sewage treatment facilities in the past 30 years is shown by these data:

| Year | No. of plants | Million Population Served | Urban % of Population |
|---|---|---|---|
| 1920 | 1000 | 10 | 18% |
| 1950 | 6700 | 60 | 65 |

It is true that the effects of these efforts have not been general, for there are still some rivers that are as bad as ever, but the number of such streams is becoming less and less.

It must be recognized, too, that as the population increases there will be need for new services. Also, as the population density increases, there will be a need for an increase in the degree of treatment.

Question 2—Are present controls over stream pollution adequate? "Generally, yes!" according to Mr. Howson. But the public must care; the public must want to clean up. This attitude is the key to the clean-up of industrial waste as well as domestic wastes. Most states now have regular control of stream pollution and the efforts have been effective.

Question 3—At what governmental level should pollution be controlled? Mr. Howson pointed out that when Pub. Law 845 was passed in 1948, it recognized state rights, and while it set up grants in aid for study and research, the law gives the Fed. government no enforcement power except if the state so requests.

The President's Commission on Water Policy suggested that P.L. 845 be tested out, and that in 10 years it should be reviewed as to the need for Federal enforcement. Mr. Howson decried that attitude saying that final desired results can not be obtained in 10 years. He believes that the approach should be under the *evolutionary* lines under the present controls and *not* under the *revolutionary* lines of federal control.

The President's Commission also recommended that sewage treatment plants sell fertilizer. Mr. Howson pointed out that if fertilizer production and sale is tied to sewage plant construction, then the whole program will be held back. While sludge has some value as a soil builder, it now costs more to produce the sludge than it will sell for. This is not sound economy.

Question 4—Who should pay for sewage treatment facilities? Mr. Howson raised vigorous objections to the suggestion of the President's Commission that loans should be made at 2 per cent. This is not a sound idea, as such, according to Mr. Howson, who pointed out that waste treatment is within the reach of anyone who wants it at a cost of one cent per capita per day for both capital investment and operation. Grants in whole or in part should not be made!

"Wastes are contributed locally; they should be abated locally, and the abatement should be paid for by the contributors. There is no single pollution problem of national nature. True, there is national distribution of pollution, but each case is individual. Therefore, the pollution problem should be handled on the basis of local conditions."

Mr. Howson summarized by saying that a sound national water policy with respect to pollution should recognize that:

1. Two-thirds of the population now had some form of waste treatment.

2. Progress has beeen good under state and local control.

3. Pollution problems are local and should be not only controlled locally but paid for locally.

4. Loans from the Federal government for pollution abatement should only be for special conditions where interstate pollution is a vital factor, and these loans should be paid back by the local areas.

5. Greater speed in pollution cannot include the development of waste treatment for fringe areas and fringe conditions, or for fringe recovery of by-products.

6. Control of pollution abatement should be left to the several states.

*L. R. Howson, Alvord, Burdick and Howson, Chicago*

*G. E. Arnold, Chief Water Res. Div. N.P.A. Washington*

*John F. Laboon Chief Engr. Sewage Authority Pittsburgh*

*Frank L. Flood Metcalf & Eddy Cons. Engrs. Boston*

*T. C. Schaetzle Engr. in Chg. Sewage Treatment Akron, O.*

*Grant A. Pettit Ind. Wastes Engr. Armco Steel Co. Middletown, O.*

**Program Participants**

### Procurement of Materials

"PROCUREMENT OF MATERIALS—TODAY'S PROBLEM" by Gerald Arnold, Administrator, Water and Sewage Resources Division, National Production Authority, Washington, D.C.

Mr. Arnold's name was not on the program because at the time the program was prepared, Mr. Arnold had not been appointed to his position in the Water Resources Division, but was fulfilling his regular position of Director of Public Works of San Diego, Calif. Having undertaken the job in Washington but three weeks before the meeting, Mr. Arnold was not familiar with the details of how the Water Resources Division had actually come into being, and this was explained to the audience by W. J.

Orchard, Gen. Mgr., Wallace & Tiernan, who was an active participant in the efforts which culminated in the designation of the Wat. Res. Div. as the claimant agency for domestic and industrial water supply and domestic and industrial wastes.

Mr. Arnold explained the organizational set-up and just how applications are processed, how materials are requested, and how they are allotted. Taking steel as an example, Mr. Arnold said that with the military and atomic energy needs taking 50 per cent of the supply, it was obvious that civilian uses would have to exist on short rations. For this reason, it is necessary that the W.R.D. have all supporting data possible in order that a fair evaluation of projects can be made.

Mr. Arnold asked his audience to give care and attention to the preparation of applications for allotments of critical materials. "Ask only for what you really need in any quarter." "When making plans don't use any more steel, copper, and aluminum than is absolutely necessary." "Where possible, use substitute materials." "Above all, *don't* pad your application." "Applications will be granted in whole or not at all, there will be no percentagewise allotment. This is another reason for not padding the application."

Among the questions put to Mr. Arnold were the following:

Q.—What do we do about stream pollution?

A.—For example there are now some 18 places in and around New York City that are under court order to proceed with pollution abatement. This problem had not been resolved at the time of the St. Paul meeting.

Q.—How far in advance should requests be scheduled?

A.—Six months in advance is desirable, and be sure to state for what quarter the material is desired.

Q.—Must the consulting engineer take off of plans the amount of material needed?

A.—Yes and put these amounts on form CMP-4C.

Q.—What criteria are used in evaluating projects and needs?

A.—First, is the project essential to the defense program, and secondly, has there been a population load increase on present facilities?

Q—Will plans have to be submitted to the W.R.D. in the future?

A.—I sincerely hope not.

Q.—Must an applicant refile, if an allotment is not used in the quarter originally planned?

A.—Yes.

Q.—Does an applicant get credit for any scrap he might turn in?

A.—No, but get the scrap in anyway, it is very, very short at present.

Following the question and answer, period, Mr. Orchard told the audience that the Water & Sewage Works Manufacturers Assn. had undertaken the job of issuing information to everyone in the water, sewage and industrial waste field as rapidly as such information becomes available. These releases will keep the field advised of new orders, and any other information of importance to the controlled materials plan and its operation.

*Thos. M. Niles*
*Greely & Hansen*
*Cons. Engrs.*
*Chicago*

*Ross E. McKinney*
*San. Engr.*
*Research Foundation*
*San Antonio, Tex.*

**Program Participants**

*W. W. Mathews*
*Supt.*
*Treatment Wks.*
*Gary, Ind.*

*S. Mogelnicki*
*Waste Disp. Engr.*
*Dow Chem. Co.*
*Midland, Mich.*

*N. S. Bubbis*
*Genl. Mgr.*
*Sanitary Distr.*
*Winnipeg, Man.*

*Theo. Jaffe*
*Asst. Prof.*
*Univ. Florida*
*Gainesville, Fla.*

## Raw Sludge Concentration

John F. Laboon, Chief Engr., Alleghany County Sanitary Authority, Pittsburgh, Pa., reported on "THE DEVELOPMENT OF A PROCESS FOR RAW SLUDGE CONCENTRATION" for the proposed Alleghany County Treatment Works. The results of two years of studies on a pilot plant scale, representing sewage from 10,000 persons, have led to the present proposal to concentrate raw sludge by a natural flotation process and incinerate the scum without preliminary digestion or vacuum filtration. The average solids content of the concentrated scum produced by natural gas lifted flotation had been 14%, with results as high as 19.6% solids. The problem of purveying such high solids scum had been solved through the use of the Moyno pump available in capacities up to 250 gpm. The problem of incineration will be of little consequence according to incinerator manufacturers.

The process, in brief, consists of raising the temperature of the crude sludge to 90° F. and maintaining between 90 and 95° F. temperature for a 5 day period which, from pilot plant results, will effect a floating sludge mass of not less than 18% solids (82% water) that can be transferred by pumps direct to the incinerators at controlled rates. No chemical agents are involved, the flotation being entirely due to gas bubbles produced by organisms at the 95° F. temperature maintained. The subnatant liquor of surprisingly good quality can be returned to the head of the plant without raising the B.O.D. of the settled sewage by more than 7%. The concentrated sludge also digests readily or can be vacuum filtered. However, economy favors direct incineration.

FRANK L. FLOOD, of Metcalf and Eddy, consultants to the Alleghany County Authority, reported that studies indicate that the direct incineration process will prove economical at an average solids content of 14%. All indications being that a sludge (or scum) of average solids content at 18% can be expected, a study of costs indicates expected annual charges of $397,000 as compared with almost $500,000 for the combination of digestion, mechanical filtration and incineration or mechanical dewatering of raw sludge and incineration. Installation cost will be roughly $1,350,000 less for the combination of concentration by flotation, pumping and incineration than for the digestion-incineration combination. The operating costs annually are predicted as $219,550 for the flotation-incineration scheme as against $335,600 for the combination of vacuum filtration and incineration. The over-all cost of disposal of dry solids per ton looks to

be $9.92 for the flotation-incineration scheme as against $12.50 for either of the two other schemes outlined.

The concentration (flotation) tanks will be rectangular with three compartments 105 ft. long, 15 ft. deep and 15 ft. wide. Three longitudinal sludge collectors will be installed. After the 5 day flotation period the subnatant liquor will be bled off and the settled scum pulled to the end sumps by the collectors. Cross screw conveyors will deliver the concentrate to the Moyno type sludge pumps. The tanks will be kept at optimum temperature by heating coils in the floor of the tanks and a slight vacuum will be maintained on the air tight tanks. The evacuated air will be delivered to the incinerator intakes.

Mr. Flood also pointed out the possibilities which this flotation method of sludge concentration possessed in combination with sludge digester operation.

### High Rate Chemical-Biological Treatment

Professor Theodore Jaffee of College of Engineering, Univ. of Florida, recounted results of experimental studies of "HIGH-RATE CHEMICAL AND BIOLOGICAL TREATMENT OF SEWAGE" conducted under his direction in an experimental plant treating 23,000 gpd. flow and involving a 3 hour period from plant inlet to outlet. An activated slurry resembling activated sludge was produced with less than 0.2 cu. ft. of air per gallon. The effluent averaged 28 parts B.O.D. Then this scheme was assisted by the addition of calcium-carbonate slurry to simulate the socalled "Daytona Beach Process" which involves the addition of softening plant sludge to the sewer without much attempt at regulating the ratio of softening sludge to sewage flow. The university studies indicated 0.75 p.p.m. of $CaCO_3$ to be the optimum feed, which with as little as 0.11 cu. ft. of air per gal. and a 2.8 hr. detention period produced an effluent averaging 24 parts B.O.D. from a raw sewage (domestic only) of 250 parts B.O.D.

Prof. Jaffee felt that several factors required more study but that the combination of 1 part per million of $CaCO_3$ with 0.13 cu. ft. of air per gal. could be relied upon to effect an 83% B.O.D. reduction in 3 hours of retention from inlet to outlet of the plant. Digestion of the $CaCO_3$—Biological sludge had proven practical.

A. J. FISCHER, Development Engr., The Dorr Co., Stamford, Conn., in commenting on the Jaffee findings, said that the process looked feasible for weak domestic sewages in a relatively fresh condition. The $CaCO_3$ served apparently as a weighting material similar to the use of asbestos fibers abroad. As to interference with digestion, it had been shown that softening sludge in the proportion of 1 $CaCO_3$ to 1 sewage solids on the dry basis would not interfere with digestion but more would slow down digestion. As to the process withstanding shock loadings as claimed by Prof. Jaffee there had been nothing but normal variations in sewage strength to contend with in the University studies, therefore no proof that the process would not, like activated sludge, also suffer from shock loadings.

### Activated Sludge Fundamentals

Ross E. MCKINNEY, San. Engr., Foundation of Applied Research, San Antonio, Texas, reported on "AN APPROACH TO THE FUNDAMENTALS OF THE ACTIVATED SLUDGE PROCESS" which recounted the findings from a study of activated sludge made while a Research Fellow at the Mass. Inst. of Technology.

This digest can not be considered adequate in attempting to cover the ground which Mr. McKinney covered through use of graphs on the screen. In the main it was pointed out that a variety of bacteria can be effective in production of the flocs which comprise activated sludge. Pure cultures of *E. intermedium, N. actinomorpha, P. aerogenoides, A. aerogenes* and the *Flavobacterium* all gave good B.O.D. removal in 24 hours of aeration. B.O.D. removals of 76 to 88% were increased to 94% or better when the organisms were fed clarified sewage. It was of interest that the great majority of the B.O.D. was removed during the first two hours of aeration by all cultures.

Mr. McKinney, in explanation of the most probable mechanism in the production of activated sludge flocs, stated that both the bacteria and the colloids of sewage carried negative electrical charges. This fact had proved a stumbling block to earlier investigators. In the aeration tank these charges change rapidly due to the rapid change of the Oxidation-Reduction Potential (O.R.P.) from negative to positive. The result is a rapid growth of aerobic bacteria. This together with the changed potential results in greatly increased collisions between the bacteria which in turn effects clumping and eventual clotting and flocculation of bacteria and colloids. The organic colloids supply food to the bacteria and the inorganic materials absorbed or occluded produce the all desirable mass increasing the settleability of the flocs.

This, said Mr. McKinney, explains only the first stages of the activated sludge process, and much more exploratory work is required to explain subsequent phenomena in the process. Until such understanding is realized the maximum utilization of the activated sludge process will not be possible.

GAIL P. EDWARDS, Prof. Public Health Engineering, New York Univ., New York City, in discussion, stated that it has not yet been determined what organisms do the best job in the activated sludge process and seemingly the effect is best obtained with a combination of several organisms. As to the maximum B.O.D. reduction taking place in the first two hours of aeration, Mr. Edwards called attention to the fact that socalled "Step Aeration" was based on this observation.

### Filter Fly Control

T. C. Schaetzle, Engr. in Chg., Sewage Treatment Works, Akron, Ohio, reported on experiences with "CONTROL OF THE PSYCHODA FILTER FLY AT AKRON, OHIO."

During the past five years many control measures and a variety of larvacides and insecticides had been tried at Akron, involving a $50,000 expenditure. Many methods of spray application to the stone bed surfaces had been tried.

The most effective agent tried had been Benzene Hexachloride at the rate of 4.5 gals. per acre of filter bed surface applied as a spray using a John Dean sprayer with 20 nozzles mounted on a 1½ ton Ford chassis. Spraying at 6 week intervals appeared necessary. After the spray application the bed remains idle for 2 hours.

Mr. Schaetzle reported at some length on the use of 5% D.D.T. in No. 2 fuel oil, applied to the syphon chambers, penta-chlor phenol, lethal and D.H.C. It was his thought that perhaps the ultimate solution might lie in rotating the most effective insecticides.

As a corrective for ponding the top stone is harrowed to a 10 inch depth in the spring and fall. Concerning flooding of filter beds for fly control, Mr. Schaetzle pointed out the need for repeating flooding at 7 day intervals and the deleterious effect of such flooding on filter efficiency.

## Industrial Waste Session

At the Tuesday morning session four papers discussing as many types of industrial wastes were presented. Presiding at this session was F. W. Mohlman, Director, Division of Lab-

oratories, The Sanitary District of Chicago, Illinois; Advisory Editor, Sewage and Industrial Wastes.

### Plating Wastes

"THE PROBLEM OF PLATING WASTES FROM AN ELECTROPLATER'S VIEWPOINT" by A. Kenneth Graham, President, and H. L. Pinkerton, Chemical Engineer; Graham, Crowley and Associates, Inc., Consulting Electrochemists and Engineers, Jenkintown, Pa.

According to Mr. Graham, who presented this paper, all investigations have emphasized the complex nature of metal plating wastes. Each plating bath is a water solution of the metal to be deposited, and a few or many such baths comprise the plating wastes (containing the anions of the metals employed). There is wide variation between industrial plants in the number and type of plating wastes; proper treatment methods can be selected only on the basis of operations in a particular plant. Electroplating wastes may be broadly classified as those from job plating shops or as those from routine industrial plants, the latter representing about 80 per cent of the metal consumed.

Robt. F. Orth
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**Manufacturers Ass'n Board Members**

Chemical nature of the plating waste is of less importance than the operations performed in the plant. The waste problem may be lessened by reduction or solved by elimination of the wastes; this approach holds considerable promise, as savings in both water and chemicals can be accomplished. The plant location must be taken into consideration, as it may involve the use of municipal sanitary sewers, local service charges, and limits on constituent concentration. The plating waste problem can be solved only through cooperation of engineering talent. Sanitary engineers are involved, but seldom have adequate experience in this special field and must utilize the services of competent electroplating engineers.

In discussing this paper, WILLIAM S. WISE, Chief Engr., State Water Commission, Hartford, Conn., spoke of the human side of waste treatment—which generally receives less consideration than the technical side. An advantage of having a trade association undertake such studies is that its members look to it for guidance and help. When waste treatment problems are considered in connection with the selection of the plant location, they can be more successfully and economically solved. The discharge of industrial wastes into municipal sewers may adversely affect both sewage treatment and sludge digestion processes. Some concentrations of toxic materials are less, or no more, burdensome when discharged directly to receiving waters. Copper in wastes may be a beneficial constituent in biological treatment (when the concentration is 100 ppm.), or it may be toxic (when the concentration is 200 ppm.). Standards are essential for the regulation of permissible concentrations.

### Chlorine and Phenolic Wastes

"TREATMENT OF PHENOLIC-BEARING WASTES WITH CHLORINE" by A. E. Griffin, Director, and Noel S. Chamberlin, Sanitary Chemist, Technical Service Department, Wallace and Tiernan Co., Inc., Newark, N. J.

Mr. Griffin pointed out there are phenols and phenols—that is, an industrial waste may contain either a single phenol or a mixture of phenols; the latter represents a much more complicated waste treatment problem. Residual phenols are undesirable both in relation to the potability of water and to the industrial use of water. While some natural oxidation of phenols may occur in the receiving stream, the process is not dependable.

Cooperative studies have been made at the plant of the Hamilton Coke Division, Armco Steel Corp., Middletown, Ohio, to evaluate the applicability of chemical oxidants (chlorine, ozone, or chlorine dioxide) for treatment of residual phenol after primary treatment of wastes. Treatment with chlorine is not a recovery method, but represents oxidation (hopefully, Mr. Griffin said, *complete* oxidation) down to carbon dioxide and water. Pilot plant studies indicate 8 to 10 parts of chlorine to 1.0 part of phenol is the general requirement; the major demand not being due to the phenolic compounds, but to chlorine-demand substances associated with the phenols.

By means of excellent lantern slides, Mr. Griffin illustrated phenol and color removals resulting from chlorine treatment of coke plant wastes. Color changes ranged from the black of the original wastes to the water-clear appearance of the treated waste (for which as much as a 10,000 ppm. concentration of chlorine was required). Treatment of phenolic-bearing rubber processing wastes was also illustrated: these wastes, at the plant of the Pequanoc Rubber Co., Butler, N. J., also required pretreatment by coagulation for economical chlorine oxidation. A full-scale plant to apply this treatment has been installed.

GRANT A. PETTIT, Industrial Waste Engineer, Armco Steel Corp., Middletown, Ohio, commended all participants in the cooperative study referred to (Ohio River Valley Sanitation Commission, State Department of Health, Wallace and Tiernan, Ozone Processes Division, Mathieson Chemical Corp., and Armco Steel Corp.). He noted that the waste represents about 30 gal. of effluent water for each ton of coal carbonized.

A. E. Griffin
Tech. Service
W. & T. Co.
Newark, N.J.

Robt. S. Shaw
Distr. Engr.
N.J. Dept. Health
Trenton, N.J.

**Programmers**

Laboratory studies demonstrated all three oxidants could be successfully applied, and the results were confirmed by pilot plant studies. Treatment by chlorine requires control of the pH value of the waste (between pH 7 and 10); oxidation by ozone or chlorine dioxide can be accomplished at any pH value (best results were obtained at about pH 11.5, as the waste is discharged from process). The degree of treatment and the relative cost of the treatment must be considered in relation to each oxidant. The cost of equipment required may vary inversely to chemical costs. This research investigation has demonstrated three new methods applicable to treatment of phenolic-bearing wastes.

### Ammonia Still Wastes

"TREATMENT OF AMMONIA STILL WASTES BY THE ACTIVATED SLUDGE PROCESS" by W. W. Mathews, Superintendent, Sanitary District of Gary, Indiana; Second Vice-Presi-

dent, Central States Sewage and Industrial Wastes Assn.

Results of an experimental plant scale study to determine the ability of an activated sludge treatment plant to handle ammonia still wastes were reported by Mr. Mathews. Fortunately, during the period involved—October 1950 to April 1951—ideal conditions existed at the Gary plant, and industrial cooperation was excellent throughout.

Some 20,000 tons of coal were coked each day. The amounts of water (25 gal. per ton of coked coal) and of phenol 0.1 pound per ton) were relatively low as a result of care in preparing the coal mix. Other characteristics of the waste: B.O.D., 1200 to 1900 ppm.; suspended solids, 1000 to 2000; and volatile material, 7 to 46 per cent. By the end of the study, a monthly average of 1,578 pounds of phenol was being treated in the activated sludge plant.

Dissolved oxygen in the plant effluent was generally maintained at 3.0 ppm., and 1100 ppm. of suspended solids were carried in the mixed liquor. During the study, 134,000 pounds of phenol was received and the overall reduction accomplished was 99.4 per cent. An increase in the air supply, up to 48 per cent more than that originally used, was necessary.

Except for the first two weeks of the study, appearance of the final clarifiers was excellent—the bottom rakes were visible 90 to 95 per cent of the time. Results showed the activated sludge plant could handle 12.3 ppm. phenol (or up to a maximum of 25 ppm. provided no other toxic material is present); some decrease in gas production occurred; more air was required; and an increase in the rate of return sludge was necessary.

Stanley Mogelnicki, Research and Devel. Engineer, Waste Disposal, The Dow Chemical Co., Midland, Mich., discussed Mr. Mathews' results and termed his study a significant example of cooperation between municipalities and industries. He stated that the biological oxidation of phenol is readily accomplished by the usual sewage organisms, and that the design of a treatment plant should be based on complete oxidation.

In his opinion, it was unnecessary to increase solids in the mixed liquor above the concentration ordinarily maintained, and, further, a 30 min. period would be sufficient for biological oxidation of phenol. Mr. Mogelnicki believes the phenol is completely destroyed and that this constituent would, therefore, have no effect on sludge digestion. Operating experience at the Dow plant has shown that the appearance of final tanks is not necessarily a guide to the quality of treatment. He replied to a question by L. H. Enslow (who questioned the effect of steady conditions at Dow's plant, as compared with variable loadings at the Gary plant), agreeing that the relative concentration of domestic and industrial wastes would influence the treatment process.

### Chromic Acid Recovery

"Recovery of Chromic Acid from Plating Operations" by Frank R. Keller, Superintendent, C. C. Cupps, Engineer, and R. E. Shaw, Plating Supervisor, The Standard Steel Spring Co., Newton Falls, Ohio.

Mr. Cupps illustrated, by means of lantern slides, many details of operating practices which have resulted in a 55 per cent reduction of chromic acid loss in this plant. The flow diagrams showed this to have been accomplished by careful carry-over control within the plating process.

Don E. Bloodgood, Prof. of Sanitary Engineering, Purdue Univ., Lafayette, Ind., commended the thorough analysis responsible for the solution of this problem. Concentration and evaporation processes have not been widely used, but can be very effective. There are likely to be problems of corrosion involved in applying these processes to industrial waste recovery, but many resistant materials are now available.

## Pollution Abatement and Control

The Tuesday afternoon session, presided over by H. R. Rudgal, Vice-Pres. and Mgr., Gary-Hobart Water Corp., Gary, Ind.; President, Central States Sewage and Industrial Wastes Assn., reviewed pollution problems at state and local levels.

"Fifty Years of Pollution Abatement in New Jersey" by Robert S. Shaw, District Chief Public Health Engineer, New Jersey State Dept. of Health, Trenton, N. J.

Mr. Shaw's paper constitutes a valuable reference to the development of pollution abatement practices in New Jersey. This state is heavily industrialized, it has a population of 5 million within an area of 8,000 sq. mi., and approximately 60 per cent of the land is potable watershed.

The entire program of stream pollution abatement and potable water supply protection was placed under the jurisdiction of the State Board of Health in 1908. In 1914, a Bureau of Sanitary Engineering was organized and given responsibilities in these public health matters. The New Jersey Sewage and Industrial Wastes Association was organized in 1915, and a State Licensing Law for plant operators was made effective three years later. In 1921 a new state law was passed requiring the issuance of a permit for the discharge of wastes before a new industrial plant can be operated.

The Bureau of Sanitary Engineering has been enlarged steadily and its functions have broadened. It participates in the Interstate Sanitation Commission and in Incodel. More than 85 per cent of the state's population is now served by sanitary sewer systems and, with plans under development, there will be 95 per cent so served. Secondary treatment and chlorination is required for practically all plants. Mr. Shaw cited sound control legislation, good administration, an adequate staff of competent engineers, and operator licensing for the high status of pollution abatement in New Jersey. The accomplishments of the first fifty years set a high standard for the future.

Morris M. Cohn, Editor, Wastes Engineering; Director of Environmental Sanitation, City of Schenectady, N. Y., discussed the paper presented by Mr. Shaw in terms of the three D's of pollution control: Demand, Desire, and Dollars. Pollution abatement laws create the first "D"; education of the public and of officials leads to the second "D"; and the third "D" is necessary to make effective the first two.

### Control by Classes and Standards

"Pollution Control Through the Mechanism of Classes and Standards" by Anselmo F. Dappert, Executive Secretary, Water Pollution Control Board, New York State Dept. of Health, Albany, N. Y.

Mr. Dappert's paper was presented for him by W. H. Larkin, Chief, Water Pollution Control Section, N. Y. State Dept. of Health. The recent and general trend toward adoption of standards was discussed, and the author considers the adoption of classes and standards can accomplish control of pollution most effectively—with the provision that engineering judgment enter into the necessary decisions. Stream use (for water supply and for effluent disposal) must determine the need for some system of classification and standards which is applicable.

In New York State, the best use of stream waters is being classified by grades ranging downward from Class AA, which is applicable to natural waters sufficiently good for potable

**Caught by the Cameraman**

*"Bob" Simms, Supt. and T. E. Robinson Plant Supt. Dept. Water and Sewerage Spartanburg, S.C.*

*Tom Niles Cons. Engr. Chicago and Jack Gould Director Pub. Wks. Richmond, Va.*

*John Wakefield Fla. Dept. Health "Bill" Weir Ga. Dept. Health Tom Berrigan Chief Sewerage Engr. Boston*

*Albert Ullrich Supt. W. & S. Treatment Austin, Tex. and John Gross W. & S. Wks. Mag. Chicago*

*Geo. Rawlins Cons. Engr. Charlotte, N.C. and E. C. Hubbard N.C. Dept. Health Raleigh, N.C.*

use after only effective disinfection; and Class A, waters which are potable after both purification and disinfection treatments. Every effort has been made to express the standards in general language.

Industries of the state insisted on the adoption of a system of classes and standards, and many benefits have developed from the public discussion which preceded the classification of various streams. To classify or not to classify is a question subject to much debate, and Mr. Dappert voted "Yes" only after careful study and analysis of the question.

E. SHERMAN CHASE, Metcalf and Eddy, Consulting Engineers, Boston, Mass.; Vice-Pres. FS & IWA., in discussing the paper, expressed certain reservations as to an elaborate system of classes and standards. He noted that the earliest of such systems, adopted by Pennsylvania in 1923, was based on a much more simple division of natural waters (only 3 classes were defined).

In the New York State system, Mr. Chase pointed out some standards as very exact and others as somewhat vague; i. e., the dissolved oxygen test is defined, but the time of year when the test is made is not specified. While standards are presented for guidance only, it is expected that they will be taken as rules. Not only is great time and cost involved in the original classification of various water basins, but future repetition may be necessary.

Flexibility of the system was evident in replies which Mr. Larkin gave to specific questions raised by Mr. Chase. If an industry desired to locate on a virgin stream, the Board would hold a public hearing to determine the best usage of the stream to the community involved. Streams can be reclassified by means of new surveys and new public hearings.

### Sanitary District Problems

"PROBLEMS AT THE GREATER WINNIPEG SANITARY DISTRICT" by N. S. BUBBIS, General Manager, Greater Winnipeg Sanitary District, Winnipeg, Man., Canada.

BUBBIS briefly described the collection system and the treatment plant of the District, which comprises the cities of Winnipeg and St. Boniface, and also four rural municipalities (covering approximately 80 sq. mi. in area). There are 448 miles of interceptor sewers, and the flat nature of the terrain necessitated construction of 16 pumping stations with 8 river crossings. The system includes 24 comminutor installations, of which sixteen are combined with pumping stations.

The treatment plant provides primary treatment (secondary treatment may be added if required), heated sludge digestions (primary and secondary units), elutriation, and vacuum filtration. The combined sewer system presents maintenance problems—ten men and three trucks are continuously employed in servicing every pumping station each day, though all stations are automatic in operation. After five years of use, sludge digestion capacity (originally 1 cu. ft. per capita) has been found inadequate—largely because of the volume of meat packing waste contributed. New digestion units planned will provide 2 cu. ft. per capita; turbo mixers, now used on two digesters are found to be helpful will be provided on all units.

Industrial wastes cause considerable trouble and expense; industrial cooperation was difficult to obtain, but has been accomplished through new municipal regulations and licensing. Disintegration of concrete sewers (especially those built, prior to 1932, of Portland cement) has been caused by the alkaline clay subsoil. Repairs, using resistance concrete, have been costly and are not long successful. Other protective coatings have not proven effective, but present investigation of Ciment Fondu (a lumite cement) appear promising.

**Tech. Program**
*F. W. Gilcreas N.Y. Dept. Health Albany, N.Y.*

**Committee Chairmen**
**Conv. Mgment.**
*W. J. Orchard W. & T. Co. Newark*

**Publicity**
*L. H. Enslow W. & S. Wks. Mag. New York*

## W.&S.W. Readers Cited For Long Public Service

**LaDue, McFaul, Cohn, Andrus Receive A.P.W. Award**

"For long and distinguished service in the field of public works," the following readers of *Water and Sewage Works* were cited and honored by the Am. Public Works Ass'n., at its recent Annual Public Works Congress held in Detroit.

Those named below were recipients of the Samuel Greely Award, which is voted members of A.P.W.A. who have served a single community for a period of 30 years or more.

Amongst the members so honored this year were:

*Wendell R. LaDue, Supt. and Ch. Engr., Bureau of Water & Sewerage, Akron, Ohio; Wm. L. McFaul, City Engr. and Water Works Mgr., Hamilton, Ont.; Morris M. Cohn, City Sanitary Engr., Schenectady, N.Y.; Harold L. Andrus, City Engr. and Dir. of Pub. Wks., Kalamazoo, Mich.*

# Waste Savings Accomplished by American Maize Products Co.

Results of a seven-year program. Pollution reduced by 92 per cent; cost $850,000; return $175,000 per year.

*by* E. M. VAN PATTEN, *Bacteriologist, and* G. H. McINTOSH, *Chemist, American Maize Products Company, Roby, Indiana*

AMERICAN Maize Products Company is a producer of corn products by the wet milling process. Its plant was situated in the north part of Hammond, Indiana, in the year 1907, largely because of the availability of an unlimited supply of water from Lake Michigan for cooling and process purposes. During the past several years, process water requirements have frequently reached 15 m.g.d.

Prior to the year 1940 there were no sewage treatment facilities of any nature in the plant area, and the entire volume of plant effluent was discharged into Lake Michigan. The wastes contributed as much pollution as domestic sewage from 350,000 persons, or 10 population equivalents per bushel ground. In 1940 the Hammond Sanitary Board constructed an intercepting sewer into the northwesterly part of Hammond in order to divert sanitary sewage and trade wastes to the modern treatment plant of the district. Since then, Amaizo has diverted all of its sanitary sewage and a portion of its trade wastes to the treatment plant of the district. This relieved the pollution of Lake Michigan considerably, but the company continued its program of waste abatement with purpose. On September 18, 1944, Amaizo agreed to make further improvements which were incorporated in a stipulation filed in the case of the State of Illinois vs. State of Indiana et al, in the Supreme Court of the United States.

A definite program of procedure was outlined in 1944, which program was finally completed in September 1950 and subsequently resulted in the company's dismissal from the case on November 6, 1950. For the last quarter of 1950 total trade wastes discharged by the company averaged .7 of a population equivalent per bushel of corn ground. Of this volume, wastes essentially very dilute entrained glucose solids were discharged with cooling waters to Lake Michigan at the rate of approximately 300 pounds per day. The balance was sewered to the Hammond sanitary system.

Generally speaking, the program was accomplished by the segregation

E. M. Van Patten

G. H. McIntosh

of all waste bearing waters, the reuse or bottling up of many process waters, the recovery of all recoverable solids, and the maximum reduction of volatile organic matter. The company realized that it was not in a position to attack the problem as sanitary engineers specializing in waste disposal, and considered that this method of approach was the most feasible. It was hoped that improved process operations and increased solids yield resulting from such a program would defray a part of the heavy capital expenditures required for waste abatement. It is believed that plant effluents are as good as can be obtained under present conditions of development in the industry; pending developments, which may be of further benefit, will be discussed later in the paper.

## The Manufacturing Process

Before reviewing the method and results of our abatement program, a brief description of the 24 hour continuous wet milling process will be helpful. At our plant, cleaned shelled corn is steeped in a weak solution of sulfurous acid. The corn (45,000 bu. daily grind) is then doubly milled by attrition and finally by Buhr mills. This milled material is separated into the following fractions: starch, germ, proteinaceous solids, fibrous material and soluble solids.

Dextrines, gums and food starches are manufactured from the basic starch carried in water suspension and in many instances chemically treated. (The filtrates from these slurries are mostly very dilute waters, the solids from which have very little commercial value yet represent a source of trade waste.) Corn syrups, dextrose sugar, lactic acid and many other products are manufactured from dilute water starch suspension by acid hydrolysis or microbiological conversions. (These dilute products must be concentrated before they are in marketable form and this concentration involves the use of elaborate vacuum evaporation equipment, condensates from which are all subject to dilute solids entrainment.) The proteinaceous material is either combined with the soluble solids and fibrous material or converted directly to animal feed. The entire process is a wet milling process and all materials are handled as slurries to the last manufacturing steps.

## The Waste Problem Outlined

As of January 1, 1944, an extensive six months survey and study of all Amaizo industrial wastes was initiated for the following purposes:

1. To classify the pollution load of industrial waste as to all individual sources.

2. To determine basic characteristics and magnitude of waste from each source.

3. To determine the seasonal fluctuation affecting each waste.

4. To develop methods to reduce and control the strength of these wastes.

A special group within the research department was equipped and trained for the survey. The personnel collected analytical data on volume, B.O.D. loading, gravimetric solid loading, and bacterial contamination; and obtained basic information on the bio-loading potentials of various organic matters subject to inclusion in our trade wastes. The group also made studies of pre-treatment and process water reutilization practices applicable to reducing the industrial waste problem.

The following principal sources of trade waste were recognized:

1. Refinery bone wash water.

2. Volatile and sugar solids carry-over in refinery condensate and sugar evaporator pan concentration.

3. Volatile and solids carry-over in the evaporator concentration of steep

water, process water and filtrate waters.

4. Lactic acid and calcium lactate carry-over from evaporator pans.

5. Small amounts of modified starch and common starch wash water.

6. Excess plant process and manufacturing water which was not economical to concentrate because of the low solids content.

7. Surface sewer water and waters from floor washing operations.

8. Inadequate equipment for handling spills and the occasional failure of process equipment.

9. Oil refinery operations (deodorizer and wash water).

### Discharge Systems in 1944

The Amaizo plant is served internally by two discharge systems, the city of Hammond Sanitary System and the Lake Michigan Discharge System. In 1944 both Lake Michigan and Hammond sewer systems were so laid out that trade waste loadings could easily be diverted from one system to the other. This was done by diversion chambers. All sanitary wastes were isolated so that there was no possible way for their disposal into the Lake Michigan system.

All of Lake Michigan discharge waters are collected in a large well located within the plant properties. These waters are continuously sampled (24 hour basis) and then pumped from the well into a 36 inch sewer which discharges into the lake. In 1944, the total volume of trade waste effluent discharged to Lake Michigan ranged up to 15 m.g.d.

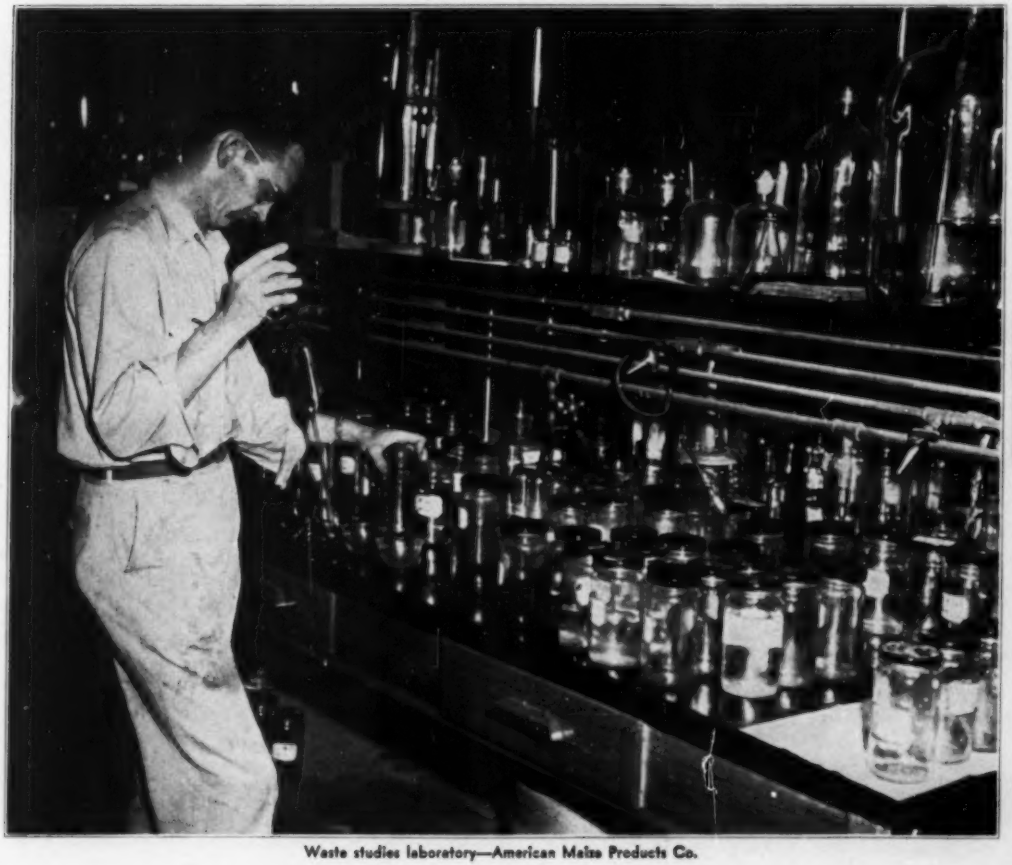
The Lake Michigan discharge system was served by three main arterial lines discharging into the common collection well. These were:

Feed House Artery. Cooling and condensate waters from the Feed House steep water and process water evaporation pans. Starch filter vacuum seal waters and manufacturing water heat exchanger condensates. Oil Refinery vacuum deodorizer barometric downleg waters.

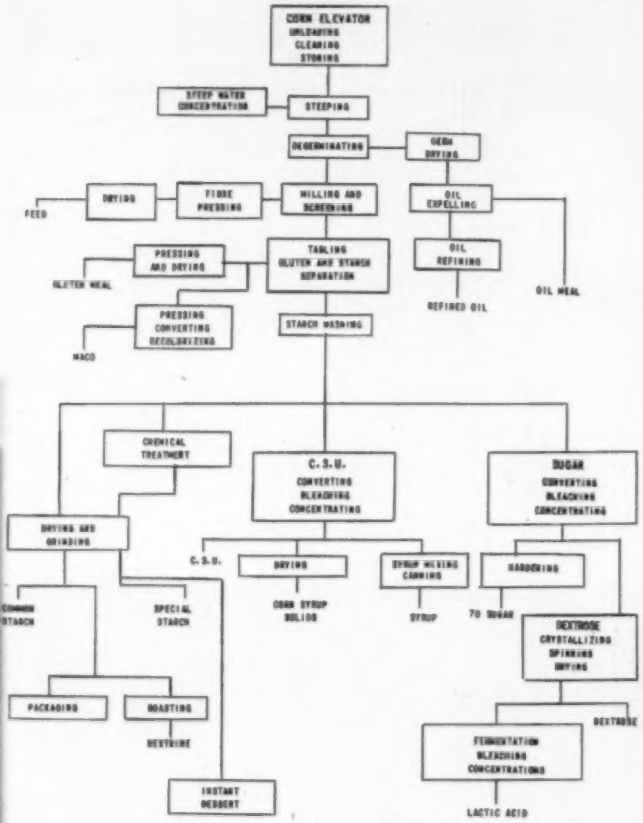
Glucose Refinery Artery. Cooling and condensate waters from corn syrup and sugar vacuum concentrating pans. Refinery bone filter wash and tempering waters. Floor wash water and waste water from Refinery process equipment.

Lactic Acid Department Artery. Cooling and condensate waters from lactic acid and calcium lactate vacuum concentrating pans. Lactic Acid Department wash waters. Dextrose crystallizer cooling water. Frodex Department cooling water and some wash water. Boiler House cooling water and boiler blow-down water. Water treatment plant filter back wash water.

Having established these three main arteries which make up the basic structure of the Lake Michigan discharge system, it was possible to evaluate the actual 1944 loading picture in some detail. To provide this data, automatic sampling devices were installed on each of these three main



Waste studies laboratory—American Maize Products Co.




Flow chart—wet milling process for corn.

arteries as well as all possible contributing lines and equipment, no matter how isolated they might be. Various metering methods were established for all contributing sources of effluent. All samples collected were eight-hour shift composites. All automatic sampling devices were checked against series of one half hour composite grab samples for performance, before the samplers were used routinely. This check system has been established as standard practice and is continuously observed.

## Results of Investigation

The investigations revealed the following:

*A. Glucose Refinery contribution to Lake Michigan Discharge, bio-loading in 1944.*

1. Bone Filter wash and tempering water. Average daily volume = 180,000 gal. Average daily loading = 30,000 p.e. (population equivalent).

2. Glucose and Sugar Liquor concentrations. The Refinery was equipped with one double effect glucose pan, one double sugar pan, and four batch pans for final heavy liquor concentration. The pans had the capacity to evaporate 200,000 gallons of water in 24 hours. All entrained solids, with the exception of those evolved from the first effects of the double effect pans were sewered with the barometric downleg cooling water. Average daily condensate volume = 200,000 gallons. Average daily entrainment per pan = 1,000 ppm. Average daily loading = 30,000 p.e.

3. Miscellaneous Refinery spills, wash water not economical to reuse and Evaporator Pan boil-out water. Average daily volume = 40,000 gallons. Average daily loading = 30,000 population equivalent.

4. Total average daily loading to Lake Michigan Discharge = 90,000 p.e. The Glucose Refinery artery contributed a daily average of 4,200,000 gallons of cooling water and 400,000 gallons of condensates and other wastes to the Lake Michigan discharge.

*B. Feed House, Oil Refinery and Wet Starch Process contributions to Lake Michigan Discharge, bio-loading in 1944.*

1. Steep Water, excess manufacturing water and Starch Filtrate concentration. The Feed House was equipped with two double effect pans and three single effect heavy liquor finishing pans. These pans were all equipped with barometric downleg condensers. All condensates were discharged with the cooling water. The pans had the capacity to evaporate 200,000 gallons of water in 24 hours. The waters concentrated by these pans had an average volatile content of 0.4 per cent by weight. These volatiles are made up of a combination of organic acids, esters, fusal oils, furfurals, aldehydes and ethyl alcohol. Average daily condensate volume = 200,000 gallons. Average daily entrainment per pan = 3,500 ppm. Average daily loading = 90,000 p.e. (entrained solids = 50,000, volatiles = 40,000).

2. Oil Refinery operations. Entrainment from vacuum deodorizer operations (fatty acids, waxes and gums). Daily bio-loading = 10,000 p.e.

3. Excess manufacturing process waters and light Starch Filtrates. Average daily loading = 80,000 p.e. A proportion of the company's dry starch business is in the specialty field. Starches are treated chemically to suit the customers' needs for body, paste clarity and gel strength. These chemical treatments render the filtrate waters incompatible for reuse in the system and often render their solids useless for animal feed. They also require special equipment for solids recovery and special methods of handling if they are to be reused. Under these circumstances their recovery for solids value alone is not economically feasible.

4. Seal water for vacuum pumps and heat exchanger condensates were thought to contribute no bio-loading. Their total daily volume averaged 250,000 gallons.

5. Filtrate waters from special Protein Concentrate department = 20,000 p.e. The Feed House artery contributed a daily average of 7,000,000 gallons of water to the Lake Michigan Discharge. None of the load bearing wastes were separated from the cooling waters. Total Average Bio-loading to Lake Michigan = 200,000 people.

*C. Lactic Acid Department Artery contributions to the Lake Michigan Discharge bio-loading in 1944.*

1. Lactic acid and calcium lactate concentration entrainment losses = 40,000 p.e.

2. Inadequate facilities for recovering spills and process wastes accounted for another 20,000 p.e.

3. All waters from the Frodex, Dextrose and water treatment plants were either cooling waters or waters containing no possible loading materials.

4. Total average daily bio-loading from these waters was equivalent to the pollution load from 60,000 people and the total water volume to Lake Michigan from this artery averaged 3,500,000 gallons daily.

### The Problem Defined

After appraising the data provided by these investigations, it was decided that corrective measures could best be accomplished in the following steps:

1. Reduce solids entrainment losses in Refinery evaporation processes to a minimum by the installation of new concentrating equipment or the rebuilding of existing facilities.

2. Isolate all condensates from cooling waters in the steep water and manufacturing water concentration operations.

3. Completely discard the Feed House concentrating equipment and install new equipment allowing for additional evaporating capacity to concentrate filtrate and wash waters that normally would be sewered. (This step would be our economic advantage.)

4. Install equipment to eliminate the excess amounts of starch wash and filtrate waters that were unbalancing the reuse of process water.

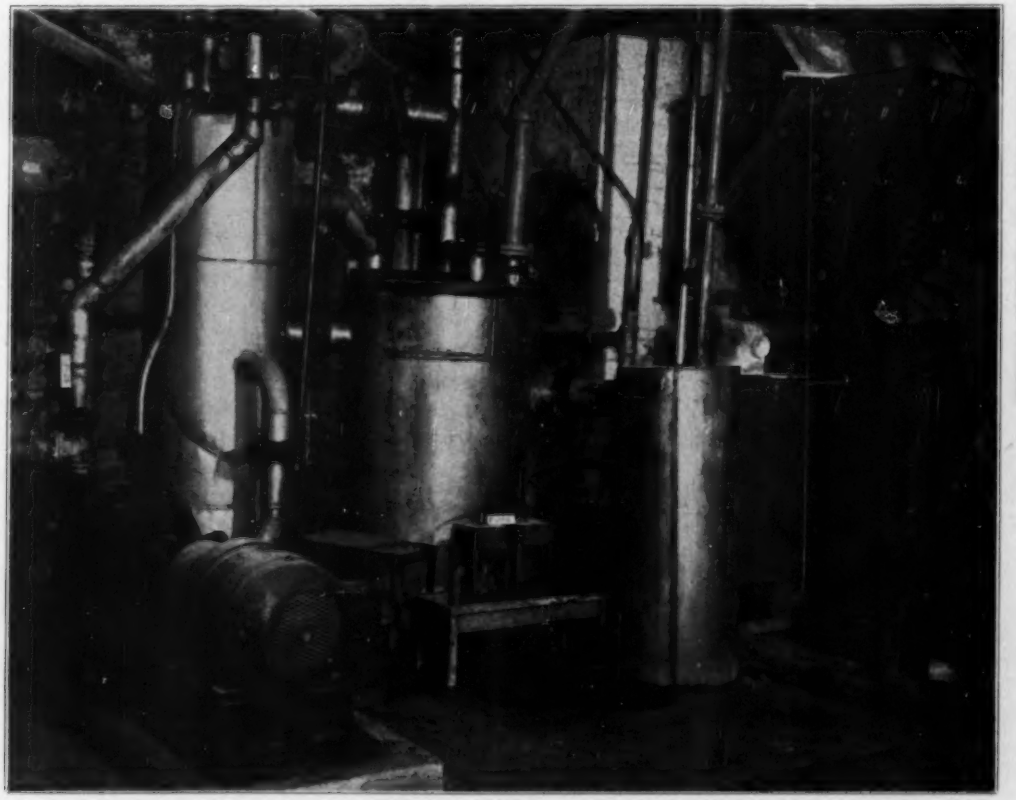
5. Devise means for limiting the amount of bone wash sewered daily.

6. Eliminate the sewering of evaporator pan boil-out water and devise other means of separately disposing of this material. (Vacuum evaporator pans must periodically be boiled out, either with a caustic or an acid solution depending on the fabrication of the pan, to clean the tubes of salts and soaps which foul the tubes and reduce evaporation efficiencies. These boil-outs must be made after 7 to 14 days of pan operation. The exact time depends on what material is being concentrated in the pan.)

7. Completely revamp concentrating equipment and methods in the lactic acid department to eliminate losses.

8. Eliminate the sewering of all process, filtrate and manufacturing water.

With these fundamentals in mind, fabricators of vacuum concentrating equipment were consulted. The Zaremba firm proposed the fabrication of custom made vacuum pans guaranteed to meet a 170 ppm. entrainment maximum under day-in day-out operations on sugar, corn syrup or steep water concentrations. Previous laboratory experimentation had shown a 170 ppm. entrainment to have a negligible effect on the bio-loading of the cooling waters discharged to Lake Michigan when diluted in these waters totaling from 10 to 15 million gallons daily. On such a basis, entrainment losses resulting from glucose and corn sugar concentrating operations would result in a daily solids loss of from



Condensate scrubber pumps, diversion chamber and lime-feeder

150 to 300 pounds of sugar solids daily.

With the above guarantee by the Zaremba firm in mind, the company proposed the following program for eliminating its trade waste problem.

*For the Lake Michigan Sewer System.*

1. Eliminate all waters bearing organic and inorganic solids from this system, except such traces of sugar solids not possible to separate from Refinery cooling waters.

2. The only waters discharged to the lake would be waters used for cooling purposes and, with the exception mentioned in item 1, all waters would be isolated from contaminating materials.

*For the Hammond Sewer System Discharge.*

1. Discharge such low solids bone wash waters as were found impossible to reuse in the process (not to exceed a loading of 2,000 to 5,000 people).

2. Discharge condensates from Feed House steep and process water evaporation after they have been partially treated to limit their bio-loading to an amount amenable to treatment by the Hammond disposal plant.

3. Modified starch filtrate waters unsuitable for animal food concentrate would be discharged to the Hammond disposal plant in small amounts over an extended period of time.

4. Limit waters sewered to the Hammond sanitary system to a maximum of 600,000 gallons over a 24 hour period and not exceeding 40,000 gallons per 60 minute period.

## Equipment Changes Required

To meet the requirements of these proposals, the company drew plans and contracted for equipment and installations necessary to carry out the program. The company felt that the trade waste abatement problem would be essentially solved by completing the following improvements:

*A. Refinery Department.*

Refinery concentrating equipment was completely overhauled and new installations were planned that would increase the overall refinery evaporating capacity by 25 per cent, and reduce the Refinery cooling water volume to an average daily figure of 2,200,000 gal., roughly a 50 per cent reduction over old operational equipment. These Refinery pans were designed to achieve reductions in entrainment losses so great as to be not considered economical by the industry and not attained by any other processors in the industry.

*B. Feed House Department.*

1. Install a new stainless steel triple effect continuous evaporator for steep water, process and filtrate water having a 320,000 gal. per day evaporating capacity. This pan to be equipped with a surface condenser, which innovation would eliminate a barometric downleg and effect complete isolation of all cooling and condensate waters.

Incubator for B.O.D. work

2. Install a new stainless steel single effect finishing pan equipped with surface condenser having a 58,000 gallons per day evaporating capacity.

3. Repair and renew Peebles double effect pans for stand-by emergency operation. These pans would increase the Feed House evaporation capacity by 57 per cent and also effect a better than 50 per cent economy in the amount of cooling water required by the Feed House.

*C. Lactic Acid Department.*

1. Rebuild and replace all concentrating equipment for improved efficiency.

2. Provide facilities for reuse of all process waters in the department.

*D. Process Water Department.*

1. Install two large string filters for washing starches. These would decrease volume of filtrate water by 100,000 gal. daily. This installation would lighten the overall process water load, make it considerably easier to effect a balance in water reused, and eliminate the sewering of light filtrate waters.

Final delivery and installation of all the required equipment was delayed by war shortages and post-war strikes until March 1949. Until all equipment was installed, it was impossible to do much actual work on the trade waste abatement program other than the following incidentals:

1. An entire new laboratory unit of 3 permanent employees was set up under the direct supervision of the Process Chemists Department to collect daily operational data on the entrainment of process equipment, collect daily bio-loading data on various effluents, and determine trade waste losses.

2. Permanent sampling stations were installed at the various sewer outfalls.

3. Permanent metering and temperature recording devices were installed on the Hammond sewer outfall. A recording pH meter was included in this project.

4. Process methods for the reuse and bottling up of waste bearing waters were developed.

5. An educational program was initiated to inform process workers, from bottom rank to superintendents, of the problem.

6. Studies were made on ways of reducing the volatile loading of the Feed House condensates.

## Test of Improvements

The improvements agreed to in 1944 were finally completed and the installation was tested in 1949 with the following results:

*Lake Michigan Discharge Loading.*

All bone wash waters and miscellaneous floor wash waters. Entrained solids from all Refinery pan liquor concentration. These waters were not isolated from the cooling waters. All roof drain and storm sewer water. Dextrose and Frodex department cooling waters. Lactic Acid department cooling and condensate waters. Feed House cooling waters. Oil Refinery cooling and condensates. Casual filtrate waters from the corn milling and starch processing departments.

*Hammond Sanitary Sewer Loading.*

All condensates from the Feed House. All sanitary sewage.

A survey operating under the above conditions provided data on average characteristics for a three month period. The results of the survey indicated that although trade waste loading had been reduced by 66 per cent, the problem was not completely solved:

*Lake Michigan Discharge.*

Average daily volume = 10,000,000 gal. Average daily B.O.D. = 120 ppm. Average loading = 69,000 p.e.

*Hammond Sewer.*

Average daily volume = 500,000 gal. Average daily B.O.D. = 2,000 ppm. Average loading = 49,000 p.e.

*Known Dry Solids Losses.*

*Refinery.*

Evaporation entrainment to Lake Michigan = 600 lbs. sugar daily. Bone Wash water to Lake Michigan = 1,200 lbs. sugar daily.

*Feed House.*

Evaporation Entrainment to Hammond = 500 lbs. solids daily.

*Lactic Acid Department.*

Entrainment solids to Lake Michigan = 50 lbs. daily.

*An Indefinte Amount of Solids in Dilute Starch Filtrates.*

*Total Loadings.*

Population equivalent = 118,000. Known solid loss = 2,350 lbs. daily. Population equivalent loading per bushel ground = 2.9.

### The Remaining Problem

As of June 1, 1950, an intensive program was initiated to solve the remainder of our trade waste problem. The following program was outlined:

1. Develop a method of treating Feed House wastes to effect a considerable reduction in bio-loading.

2. Develop further reuse of process waters and condensates, thus effecting a more completely closed system than any previously attempted in the industry.

3. Accomplish the complete elimination of all floor drains. Existing drains could be used by the process operators to dispose of spills without supervisory detection.

A cautious approach to this program was necessary because of the possibility that it might jeopardize the quality of our finished products through the introduction of excessive amounts of salts and solubles back into the process water. Also, it could effect a reduction in the production capacity of some departments.

### Solving the Remaining Problem

After considerable research and plant scale experimentation, it was determined that it would be possible to solve the problem remaining by bottling up the starch filtrates and a portion of the Refinery bone wash waters, and by aerating the steep water condensate, thus effecting a reduction in their bio-loading potential. Pursuant to this plan, the following work has been accomplished:

*A. Starch Filtrate Waters.*

A brief picture of the water balance program now used in the milling and starch separation is as follows:

1. Light steep water from completely steeped corn is sent to steep water evaporators for concentration.

2. The steeped corn is ground, slurried with gluten settler overflow water and filtrates from final gluten (protein) filtration.

3. This slurried mixture of ground corn is separated into two fractions by gravity displacements: (a) Corn germ. (b) Fiber, gluten and starch slurry.

4. The fiber, gluten and starch slurry is passed over a series of special reels and shakers to separate the corn fiber from the starch and gluten. Considerable water is used in this process for washing reels and adjusting starch-gluten density.

5. The starch and gluten is then adjusted to a density optimum for the gravity separation on long inclined tables (7.4° Baumé average).

6. In this process a relatively pure starch fraction is left on the tables and the gluten portion of original corn is carried off in liquid suspension.

7. This liquid suspension of gluten is piped to settlers. The thickened gluten fraction is pumped from the bottom and filtered on plate and frame presses. The overflow water, as previously mentioned, is used back in the system for slurrying steeped ground corn and for making up fresh $SO_2$ water.

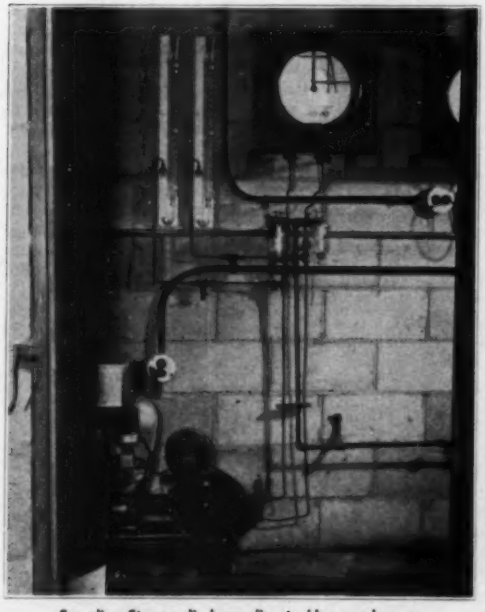
8. The starch cake is flushed from the tables, cleaned on shakers and then filtered, washed, resuspended and filtered an average of three times. This is done to remove the solubles and salts from the starch.

9. The only fresh water added to the system is added during this washing process in the form of a fine spray applied to the filter cake as it is formed on the continuous vacuum filter.

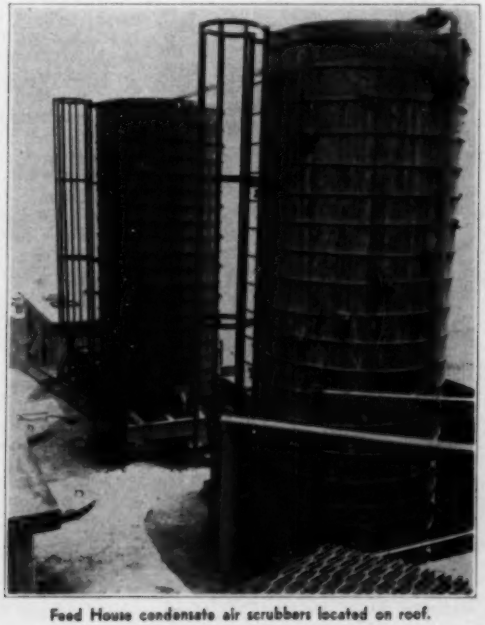
10. Filtrate from the first wash filtration is used back in the system as hose water in the Mill House.

11. Filtrate from the second wash filtration is used as flushing water to flush the starch from the table.

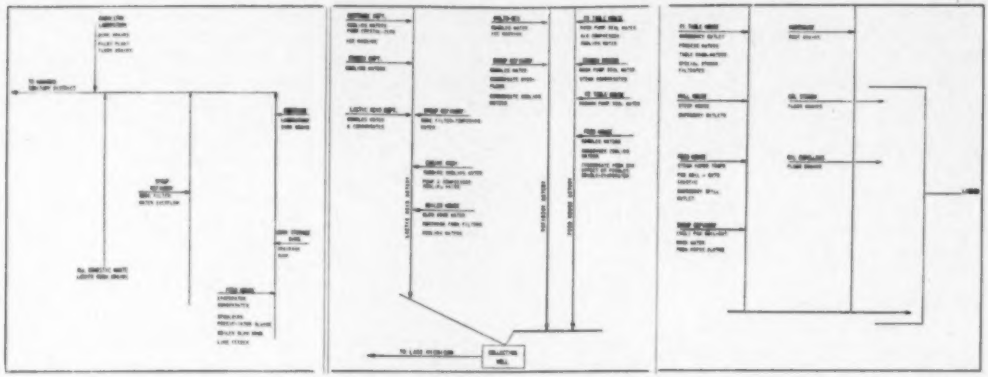
12. Filtrate from the third wash filtration is used as starch slurry



Sampling Sta. on discharge line to Hammond sewer.



Feed House condensate air scrubbers located on roof.



OUTLET DIAGRAMS, showing the type of wastes that are discharged through the three plant outlets. Hammond sewer (left); Lake Michigan Outlet (center); Lagoon Outlet (right).

make-up water for the resuspension of starch cakes after 1st and 2nd wash filtration.

13. Some excess filtrates are evaporated daily with the steep water.

14. Normally several thousand gallons daily of 3rd wash and 4th wash (special starches) filtrates are filtered to remove insoluble solids and sewered. The solubles in the sewered waters run less than one half of one per cent.

This system must be carefully balanced or poor starch-gluten separation is experienced on the tables and inferior finished starch results. Any misuse of waters resulting in excess filtrates results in a disposal problem. Filtrates used back in the system containing high salt content impairs starch quality.

With this closed system in mind, the company took the following steps to eliminate sewering filtrate waters and to reduce the use of fresh water in the system:

1. Excess starch filtrate water is piped to our wet dust collecting systems, replacing fresh water.

2. Special starch filtrates formerly considered as harmful to our bottled-up system are now used back into the system.

3. A large special starch filtrate holding tank has been constructed for slowly metering filtrates harmful to the system back to the Feed House evaporators.

4. The production of special starches producing filtrates containing salts harmful in animal feeds in any quantity has been discontinued.

5. Careful scheduling of all special starch processing is practiced, so that such processing will not upset our water balance.

*B. Bone Wash Waters.*

1. Reuse 10,000 gallons back in the Refinery system for washing presses.

2. 60,000 gallons are filtered and reused on second wash glucose starch.

3. The balance along with all press cloth wash water is sent to the Hammond sanitary system.

4. The amount of sugar solids in all of the bone wash water has been reduced to an average total of 600 lbs. of sugar per day. This is accomplished by sweetening off (flushing sugars out with fresh water) several hours longer before putting the filter on wash. This sweet water is normally concentrated separately and sold as an inferior grade corn syrup. This longer sweetening off process has eliminated a considerable amount of the dilute sugars normally sewered in the bone wash water but it has presented a problem of disposing of the excess sweet water without overtaxing the concentrating equipment and cutting the overall Refinery capacity. To overcome the major portion of this excess, sweet water is used to dilute glucose starch prior to the acid pressure conversion of the starch. Normally fresh water is used for this purpose and again through the use of sweet water the quality of our finished product is endangered.

*C. Excessive Feed House Condensate Loading to the Hammond Sewer.*

This problem was solved by:

1. Installing two air scrubber units for removing the volatile loadings from all the condensates discharged.

2. These units reduce B.O.D. loadings to the Hammond sewer by a population equivalent of about 15,000, which is a little better than a 50 per cent reduction of the original untreated loading of the condensates.

3. These condensate scrubbers are essentially open beer stills through which the hot condensates are air scrubbed with 25,000 cubic feet of forced air per minute.

*D. Miscellaneous Loadings.*

1. It was found necessary to cease refined oil operations to eliminate this source of loading. Under operating conditions as they existed this source was discharging each day a bio-loading equivalent to a population of 10,000. It would have cost $100,000 for equipment to eliminate this waste, and, under existing conditions, it was found cheaper to go out of the refined oil business.

2. Starch filter vacuum pump seal water lines were found to prime intermittently, subjecting the Lake Michigan discharge to occasional shock loads of starch filtrate water. To make this system foolproof, it was necessary to install a catch-all system to correct the priming situation.

3. Steep water and manufacturing heaters in use proved unsatisfactory. There had been occasional interchange of process water to discharge condensates from these heaters. This equipment was replaced.

4. Air scrubbed Feed House steep water condensate is now used in place of fresh water for washing the high concentrate protein cake produced in the Maco Department. This has relieved a part of the load to the Hammond sewer through water reuse.

5. All floor drains in the Lactic Acid, Refinery and Frodex departments have been bottled up so that they cannot discharge into the sewers.

6. All Refinery pan boil-out water is piped to a lagoon for ultimate natural disposal.

7. Feed House pan boil-out water is reused in the system.

8. Boiler blow-down water has been piped to the Hammond sewer system to aid in neutralizing wastes.

9. A lime feeder has been installed on the Feed House condensate sewer system to neutralize all wastes.

10. Diversion chambers have been

installed on the Feed House condensate system to divert such waters to the lagoon during emergencies. This is a guard against the possibility of overtaxing the Hammond treatment plant with shock loads due to accidental causes.

11. Condensates from the first two effects of the Refinery triple effect pans are now reused in the system, eliminating this source of entrainment from the Lake Michigan discharge.

### Summary of the Completed Program

The company now disposes of its discharge waters as follows:

*Lake Michigan Outfall Receives—*

1. Cooling waters from Feed House evaporator pans.

2. 60,000 gal. of Refinery finished bone tempering waters bearing roughly 20 lbs. daily of inorganic solids.

3. Cooling waters from the Lactic Acid Department, Frodex and Dextrose departments.

4. 20,000 gal. of condensates daily from Lactic Acid Department evaporator pans.

5. Cooling waters from the Glucose Refinery evaporator pans plus 150,000 gal. of condensate bearing from 150 to 300 lbs. of entrained sugar solids daily.

6. Cooling waters from Boiler House equipment.

7. Water Treatment Plant filter back wash water.

8. Roof drains and storm sewers.

9. The condensate vapors mixed with the barometric downleg waters of the second effect rebuilt Peebles steep water evaporator. This pan is used as a stand-by pan and is used only in emergency when the regular Zaremba evaporators are being repaired.

At present the total volume of waters discharged to Lake Michigan averages 13.5 mgd. During late fall, winter and spring operations, this volume will fall within the range of 8 to 10 mgd. as a result of cooler lake water temperatures.

*Hammond Sanitary System Receives—*

1. Domestic sewage wastes from 1,000 employees per 24 hours.

2. 200,000 to 300,000 gal. per day of air scrubbed steep water evaporator pan condensates. (Volume depends on plant operating conditions.)

3. 60,000 gal. of Refinery bone wash water. (Volume again depending on plant operating conditions.)

### Provision for Sterilization of Waste Water

At the inception of the trade waste abatement program the company realized that the bacterial condition of the waters discharged to Lake Michigan would be an important factor in the general improvement of the waters of the lake. Plans were made to ultimately accomplish a coliform bacterial kill in all waters discharged back into the lake by the expedient of super-chlorination. This accomplishment was not a part of any stipulation or agreement entered into by the company.

Early data showed the average daily coliform bacterial count of raw lake waters taken into the plant to average 300,000 per 100 ml. in 1944. The coliform bacterial count of waters discharged to the lake averaged in excess of 2,400,000 per 100 ml. during the same year. To correct this the company installed a 750 pound per 24 hr. capacity Wallace Tiernan Master chlorinator and chlorinated the influent raw water from Lake Michigan at a rate sufficient to maintain a free available chlorine residual of 0.5-0.8 ppm. in all waste discharged back to the lake. This is now standard practice.

### Review of Accomplishments

To date the company has effected a reduction in the total bio-loading of its plant effluent from a daily average population equivalent of 350,000 in 1940 to a present daily average population equivalent of 28,000. This represents a reduction in bio-loading of 92 per cent. Of the present total loading, a daily average population equivalent of 20,000 is being disposed of to the Hammond Sanitary District treatment plant. Pending developments in the industry and plant improvements now actively implemented will reduce this loading to Hammond by at least 40 per cent.

One of the factors responsible for a substantial part of the load now being discharged to the Hammond plant is the unusable residue of bone wash waters. Results of experiments now under way in another plant indicate that a new synthetic bone may be far superior to the material now in use. When a process using this new material is perfected, the company will make use of it and thus will eliminate a substantial portion of the present load now sent to the Hammond treatment plant.

In addition, the company is now committed to a modernization program consisting of the substitution of centrifuges to replace the present table separation of starch and gluten. Completion of this program will eliminate the necessity of evaporating large quantities of process water in the Feed House, and will further reduce the bio-loading to Hammond.

In effecting the 92 per cent reduction in the waste loading of plant effluent, the company has instituted control measures to eliminate the human factor as much as possible and to insure uniform operation with better than average freedom from accidental shock loads. All avenues of trade waste treatment have been thoroughly surveyed. Operating control is under the surveillance of a permanent unit of three trained laboratory employees with adequately trained supervision to maintain a twenty-four hour check of operations.

### Conclusion

To accomplish this appreciable reduction in trade waste pollution, the American Maize Products Co. has invested roughly $850,000. It has replaced equipment which under normal conditions still possessed years of usefulness, and it has injected practices into normal manufacturing operations which at one time would have been considered hazardous to final product quality. Its major accomplishment has been to reduce trade waste pollution by the elimination and saving of solids normally considered waste, rather than by elaborate pretreatment or secondary treatment methods.

American Maize has incurred direct benefits from this program, in that the company now experiences a 1 per cent increase in overall plant yields above what was once considered normal. Figured at the present cost of corn, this increase is roughly worth $175,000 a year. It should be recognized that the company has exceeded the dictates of the law of diminishing returns in order to obtain this yield increase, but the return does help to support the operating overhead imposed by the program. It has been necessary for the company to carefully control all phases of production planning to make the waste abatement program work; this requirement has proven a hidden asset in that all plant operations now run more smoothly and are under more uniform control. The general production worker has been well informed as to the part he plays in waste abatement. He has developed a genuine interest, and improved morale and closer operation control have resulted from worker training.

The company has cooperated to the fullest extent possible with the Hammond Sanitary District in solving mutual problems, and the company is deeply indebted to Mr. Carl B. Carpenter, Superintendent of the Hammond disposal plant, for his sincere cooperation and assistance.

# Laboratory Equipment and Supplies For Sewage Testing

*by*

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A VERY important factor in the design of a sewage-treatment plant is the determination of substances existing in the sewage that may influence the type of treatment required and determine the degree of treatment necessary to meet demands. Equally important, and very closely related, are the routine tests that furnish information on which plant operation control is based. Also, the efficiency of the plant is revealed from the results of laboratory tests. These become a permanent record and serve as evidence in the case of complaints or law suits.

Since the success in operation of sewage-treatment depends in a large part on the test results, every plant, regardless of size or type, should be equipped with a testing laboratory. The tests made in the laboratory are determined by the type of the plant, the character of the wastes, the amount of diluting water, degree of treatment and related factors.

The composition of sewage from different cities varies widely. This is affected by habits of the population served and type of industries that exist in the particular community. In addition, there may be a wide day to day variation in the quality of sewage in a given city. And, during the night the sewage is usually weak, while during the day it may be strong. Therefore, for examination, a large number of samples may have to be taken at different times and the results interpreted accordingly.

Treatment provided varies considerably in different plants. In consequence the laboratory tests and equipment for the following types of plants will be discussed: (1) Plain Sedimentation; (2) Chemical Precipitation; (3) Trickling Filters; (4) Activated Sludge.

## Importance of Flow Measurement

Without adequate knowledge of the variation in sewage flow, proper sampling of the sewage is very difficult. Measurement of sewage flow is particularly important where composite samples are taken as for the B.O.D. test and where chemical treatment of the sewage to aid precipitation is used. The most widely used flow measuring devices for sewage are the Parshall Flume and the Kennison Nozzle.

## Sampling Sewage

Considerations in sampling the sewage for the various types of plants is somewhat the same. Care should be taken to acquire a sample that best represents the entire flow.

Sewage is an ever-changing mixture of substances in solution and in suspension. Changes take place both with time and with place. To secure a representative sample is difficult.

There is no ideal time to sample sewage as its quality is varying continuously. A sample may be taken at any moment but its analysis must be interpreted only on the basis of the conditions at that particular moment. A sample taken earlier or later would probably show different results.

The general character of sewage is best ascertained by mixing samples taken every hour or half hour for 24 hours and analyzing the composite sample. For more exact determinations, the quantities of half-hourly samples mixed together should be proportionate to the flow of sewage at the time of sampling. As some of the suspended matter may be quite coarse, it is desirable to take one quart, or more, of sewage at each sampling and pour it into a clean basin or barrel. The contents of the barrel should be thoroughly mixed at the end of 24 hours and from 2 to 4 quarts taken from the composite for analysis. When small samples are taken for laboratory tests, care should be exercised to make sure it is fairly representative of the large sample.

Raw sewage and sewage effluents should ordinarily be analyzed within 6 hours after sampling. Polluted water should be tested within 12 hours. Certain determinations, such as that for dissolved oxygen, should be made at once at the point of collection. If the samples are kept at low temperatures, the extent of the changes taking place in them will be lessened materially.

## Preserving the Sample

Because the quality of sewage may change during the hours that the composite sample is being collected, it is necessary to keep the samples cool. The sample should be kept at a temperature between 4 and 10 degrees C., or some form of preservative may be placed in the collecting basin to inhibit the biologic action that otherwise would occur. Suitable preservatives include chloroform, formaldehyde, and sulphuric acid. A preservative must be selected that will not affect the results of the analyses to be made. No preservative can be used in the sample on which determinations of biochemical oxygen demand (B.O.D.) are to be made. Determination of this important characteristic cannot be made successfully on 24-hour composite samples of a strong sewage.

## Sewage Sludge Sampling

The procedure to follow in sampling wet sludge will depend upon where the sample is collected. If the sample is drawn from a pipe line through which the material is flowing, a small quantity should be collected at regular intervals and placed in a wide mouthed bottle or bucket. If there is a valve for withdrawing the sample, this valve should always be left open long enough to free the pipe of sludge between the valve and the main pipe line before collecting the sample. Samples collected at different depths in Imhoff and separate sludge-digestion tanks are somewhat more difficult to obtain. One method is to provide a light pole a few feet longer than the depth of the tank. Attached to the bottom of the pole should be a wide mouthed bottle. The bottle should contain a stopper attached to a cord. By lowering the bottle to the desired depth and pulling the stopper cord, the sample can be taken. Another method is to use a pitcher pump with a variable length

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suction pipe. The suction end is lowered to the level where the sample is to be taken and the sludge is pumped into the sampling bottle. Various forms of mechanical sludge samplers have been offered for sale and may be used in taking the sample.

## Sewage Tests at Small Plants

The variety of tests made at a sewage treatment plant depend largely upon the size of the plant. Many small plants do not have extensive laboratories or equipment. Also, these plants may be operated by only one or two men. Due to lack of personnel and equipment some of the desirable tests cannot be made.

The tests that can be made at sewage plants where the operator has little or no chemical training are the following: (1) settleable solids, (2) relative stability, (3) dissolved oxygen determination, (4) pH value, and (5) residual chlorine. The dissolved oxygen test is rather difficult and hence is frequently not applied in the smaller plants.

### Settleable Solids

The determination of settleable solids in graduated glass Imhoff Cones indicates the amount of suspended solids in sewage that can be removed by sedimentation. This test also furnishes a quick way of determining the amount of settleable solids removed in sedimentation tanks. Although this test is not an exact laboratory method the test has been extensively applied and is useful.

### Relative Stability

Sewage will putrify or become septic due to bacterial action and a lack of oxygen. This susceptibility of a sewage to putrify is known as putrescibility and the test to indicate this characteristic of sewage is known as the putrescibility test, but more generally referred to as the relative stability test. This test, which is simple to perform, has considerable value and may be made on effluents that have received secondary (oxidation) treatment. The test is not intended to be used on raw or settled sewage. If the sewage contains an appreciable amount of suspended or colloidal matter or germicides such as copper salts, bisulfide, or residual chlorine, the test has no value. Furthermore, the test should not be made on lime-precipitated effluents containing free caustic alkalinity. This test is only a relative test. It expresses the ratio in percentage of the oxygen available to the amount required to satisfy the complete biochemical oxygen demand. This test is being superseded by the more informative 5 day B.O.D. test, but since it is easy to perform and requires a minimum of appartus it is still used extensively as a guide to the character of sewage plant effluents and the performance of secondary (oxidative) treatment units.

### Dissolved Oxygen

The dissolved oxygen test is used to determine the oxygen in the plant effluent or at various points through the plant. If dissolved oxygen is found in sufficient concentration in the effluent from a sewage treatment plant it means that, as long as the oxygent is present, putrefactive odors will not be given off. The test may be influenced by the possible presence of reducing agents other than carbonaceous organic matter. The test has a limited value for quick information as an aid in the control of treatment-plant operation where the tests are made under similar and controllable conditions. This test will also give significant data when made in connection with the B.O.D. and relative stability tests.

### pH Test

Determining the pH value of raw and digested sludge is of value in the control of digestion tanks. This test, when made on raw sewage, will sometimes indicate whether or not industrial wastes containing acids or alkalies are being discharged into the sewerage system.

### Chlorine Residual

In case sewage or sewage effluents are treated with chlorine, it is desirable to determine the amount of residual chlorine present. This test should be made sufficiently often to assure the operator that the proper residual is being maintained. The presence of a small residual of chlorine after a contact period of 10 or 15 minutes is an indication that 99% or more of the undersirable bacteria have been destroyed.

### Jar Tests

Every sewage treatment plant using or contemplating the use of chemical precipitation should have available in its laboratory a stirring apparatus for making jar tests. This test enables the study in the laboratory of chemical dosages and methods of chemical precipitation which can be used as a guide in plant operation. The jar tests should be made each time there is an appreciable change in the quality of the sewage and should be made occasionally as a check even though there is no apparent characteristic change in the sewage. The test is of little value if the quantity of sewage flowing is unknown. The purpose of the test is to determine the minimum dosage giving the best floc and settling results. The chemical feeders must then be set accordingly.

A hand operated stirring device may be purchased from a laboratory supply company for a cost of approximately $50.00. A powered device may be acquired at a cost varying from $120.00 to $200.00. One may be devised by arranging six stirring paddles on a frame. The paddles are turned by a continuous belt powered by a small electric motor. The apparatus should be designed so that the speed may be varied or held constant between 10 and 100 R.P.M.

### Minimum Equipment

For most municipal sewage plants, it is recommended that at least the tests mentioned above should be performed with the possible exception of

Table I

EQUIPMENT NECESSARY FOR SMALL SEWAGE LABORATORY

| Equipment Required | Settleable Solids | Relative Stability | Dissolved Oxygen | pH Value | Unit Cost |
|---|---|---|---|---|---|
| Imhoff Cones | 3 | | | | $ 4.00 |
| Imhoff Cone Stand | 1 | | | | 1.50 |
| Bottles, 8 Oz., (glass stoppered) | | 12 | 2 | | .30 |
| Pipettes | | 2 | 2 | | .28 |
| Erlenmeyer Flask (500 ml.) | | | 1 | | .25 |
| Burette (50 ml.) | | | 1 | | 1.60 |
| pH Comparator and discs | | | | 1 | 20.00 |
| Nessler Tube | | | | | .60 |
| Burette Support | | | 1 | | 3.75 |
| Approx. Total Cost | $13.50 | $4.16 | $6.77 | $20.00 | |

| Equipment Required | Residual Chlorine | Jar Test | General | Unit Cost |
|---|---|---|---|---|
| Erlenmeyer Flask (500 ml.) | 1 | | | $ .25 |
| Burette (50 ml.) | 1 | | | 1.60 |
| Nessler Tube | 2 | | | .60 |
| Beakers (2 liters) | | 6 | | .85 |
| Beakers (400 ml.) | | | 2 | .32 |
| Stirring Device | | 1 | | 50.00 |
| Thermometers | | | 2 | 3.00 |
| Gunnels (short stem) | | | 2 | .24 |
| Funnels (long stem) | | | 2 | .48 |
| Ring Stand | | | 1 | .90 |
| Rings with Clamp | | | 2 | .21 |
| Approx. Total Cost | $3.05 | $55.10 | $9.40 | |

the dissolved oxygen and jar tests. If future conditions warrant, it will be desirable for other tests to be included.

The equipment necessary and the present cost to equip a small laboratory shown in Table I. This table lists the minimum amount of equipment for each of the suggested tests. The number indicates the number of pieces of equipment used in the various tests.

## More Complete Laboratories

In plants with better equipped laboratories, and with one or more men trained in the chemistry of sewage, a more extensive examination of the sewage and the sludge is desirable.

Usually the two most important tests are the B.O.D. determination and the determination of the amount of suspended and settleable solids present.

### Biochemical Oxygen Demand

The biochemical oxygen demand (B.O.D.) test is perhaps the most widely used in sewage analysis. It is used as a measure of the strength of the sewage and the reduction of the demand during treatment is commonly used to determine the plant efficiency. The B.O.D. is a measure of the oxygen required to stabilize the sewage. This test is difficult to make and requires considerable experience if reliable results are to be obtained. However, if accurate results are found, it comes the nearest to giving the true character of the sewage.

### Suspended Solids

There is value in knowing the amount of suspended solids in sewage. The suspended solids include the settleable solids as well as the non-settleable solids. Because the strength of the sewage is largely dependent upon the amount of organic solids in the sewage, it is desirable to make the determination at various points through the treatment plant to determine the efficiency of the removal units. A well designed sedimentation basis with average detention time of 2 hours or more should normally remove from 50 to 70 per cent of the total suspended solids and better than 90% of the settleable suspended solids.

The removal of the suspended solids is usually an indication of the adequacy of the physical phase of the sewage-treatment plant and the settleability of the solids. Usually the determination of dissolved solids is not made as a routine test, but is made when conditions warrant. It may be necessary to make the test when the sewage contains certain industrial wastes.

Settleable solids, which are determined volumetrically by use of Imhoff Cones, should be determined by weight on a dry basis to acquire more revealing results. It is also desirable to check the suspended solids in the final effluent to determine its clarity.

### Nitrogen Determinations

The organic nitrogen in sewage represents proteins and intermediate products of decomposition. Some of the total nitrogen in sewage is insoluble and is removed in the sedimentation basin. The total nitrogen is composed of soluble and insoluble organic nitrogen and the soluble ammonia, nitrites and nitrates. Nitrogen determinations that may be made are free ammonia nitrogen, albuminoid nitrogen, total organic nitrogen, nitrites and nitrates. Free ammonia indicates the extent of anaerobic bacterial decomposition of organic matter. Usually the raw sewage is high in organic nitrogen, low in ammonia and contains little or no nitrites and nitrates. Since ammonia formation occurs, and the ammonium compounds are soluble in water, there will usually be an increase in ammonia content through the primary sedimentation unit. Nitrites and nitrates are compounds containing oxygen and represent successive stages of oxidation. The reduction in the quantity of ammonia and the formation of nitrites and nitrates begins as oxidation starts to take place. This may take place on trickling filters, or in the aeration tanks of activated sludge plants.

Nitrites are unstable and are reduced to ammonia or are oxidized into nitrates. Their presence usually indicates that a change is in progress. Nitrates are the most stable compound form of nitrogen and their presence in effluents indicates stability. In the methyline blue stability test, previously discussed for the smaller plants, nitrates supply oxygen to the organisms, and as long as nitrate oxygen remains the sample will not putrify and lose its blue color—i.e. it will remain stable.

The various nitrogen tests give an overall picture of plant operation and can be used as a valuable index.

The tests that should be made and their relative importance will often depend upon the character of the raw sewage and the type of treatment. It is recommended that plants with a well equipped laboratory, make as many of the tests as possible. A record of the tests must be studied and the results that give the best information for the efficient operation of that particular plant, will determine the relative importance of the various laboratory tests.

Sometimes it may be advisable to make microscopic examinations, if the body of water receiving the effluent is used for recreational purposes, or serves as a water supply. Although bacteriological analyses may be made they are seldom of value in plant operation control, because it is known that intestinal bacteria are present and that the concentration of bacteria is high. This test would be more valuable to those interested in water supply or shell-fish protection.

Table II gives the laboratory equipment used for various tests. Column 1 lists the equipment for a small laboratory, where the minimum recommended tests are made. Column 2 is for an intermediate sized plant with a good laboratory. Column 3 lists the equipment for a larger plant with a well equipped laboratory, where all the recommended tests may be made.

### The Sewage Plant Library

Each sewage laboratory should be equipped with a reference library. This may vary from a few volumes in a small plant to several in a large one.

A manual giving the step-by-step procedure of all the tests made in sewage treatment should be available. A few recently published books concerning water and sewage should be on hand for reference. It is also desirable to have current technical publications available. This enables the operators to follow new developments in sewage plant operation.

The following list includes the recommended manuals, books and magazines:

LABORATORY MANUALS:

*Standard Methods for the Examination of Water and Sewage* by American Public Health Association. *Analysis of Water and Sewage* by Theroux Eldridge and Mallmann.

MAGAZINES:

*Sewage & Industrial Wastes* (formerly Sewage Works Journal), official publication of the Federation of Sewage & Industrial Wastes Associations; *Water & Sewage Works*, published by Gillette Publishing Co., Chicago. *Public Works*, published by Public Works Journal Corp., N. Y. City; *Wastes Engineering*, published by Case, Sheppard and Mann., N. Y. City.

REFERENCE BOOKS:

Babbitt, *Sewerage and Sewage Treatment*. New York, N. Y.: John Wiley and Sons, Inc., 1947.
Buswell, *The Chemistry of Water and Sewage Treatment*. New York, N. Y.: The Chemical Catalog Company, Inc., 1928.
Fuller and McClintock, *Solving Sewage*

*Problems*. York, Pa.: McGraw-Hill Book Co., 1926.
Imhoff and Fair, *Sewage Treatment*. New York, N. Y.: John Wiley and Sons, Inc., 1940.
Keefer, *Sewage-Treatment Works*. New York, N. Y.: McGraw-Hill Book Co., 1940.
Metcalf and Eddy, *Sewerage and Sewage Treatment*. New York, N. Y.: McGraw-Hill Book Company, 1935.
Texas Water Works and Sewerage Short School. *Manual for Sewage Plant Operators*. Lancaster, Pa.: Lancaster Press, Inc., 1946.
Theroux, Eldridge and Mallmann, *Analysis of Water and Sewage*. New York, N. Y.: McGraw-Hill Book Company, Inc., 1943.
(Note: These texts are listed by author's name alphabetically and not in order of importance.)

CATALOGS:

*Laboratory Equipment Catalog*. Cleveland, Ohio: The Chemical Rubber Co., 1949.
*General Catalog of Laboratory Apparatus and Scientific Instruments*. Chicago, Ill.: Central Scientific Company.
*Welch Catalog of Scientific Apparatus, Chemicals, and Supplies*. Chicago, Ill.: W. M. Welch Scientific Company, 1949.

## Table II

### SEWAGE LABORATORY EQUIPMENT FOR SMALL, INTERMEDIATE & LARGE PLANTS

(Numbers in the body of the table indicate the number of pieces of equipment used for the various tests)

(1)—Small Plants (2)—Intermediate Plants (3)—Large Plants

| Equipment Required | Laboratory Determinations (1) Settleable solids Relative stability pH Residual chlorine | (2) B.O.D. Total solids Suspended solids Settleable solids Ash; pH Residual chlorine | (3) B.O.D. Total solids Susp. solids, Sett. solids, Ash; pH Residual chlorine, Ammonia, nitrate and nitrite, Nitrogen | Unit Costs |
|---|---|---|---|---|
| Analytical balance | — | 1 | 1 | $ 90.00 |
| Balance weights | — | 1 | 1 | 17.50 |
| Beakers, 250-ml. | — | — | 12 | .30 |
| Beakers, 400-ml. | — | 6 | 6 | .32 |
| Beakers, 1-liter | — | — | 3 | .74 |
| Bottles, 250-ml. wide mouth | 12 | 24 | 48 | .60 |
| Bottles, 250-ml. narrow mouth | 24 | 36 | 36 | .60 |
| Bottles, 500-ml. narrow mouth | — | 6 | 6 | .80 |
| Bottles, 1,000-ml. narrow mouth | 1 | 2 | 8 | 1.25 |
| Bottles, acid, 5 pt. | 3 | 6 | 6 | .55 |
| Burettes, 50-ml. | — | 2 | 2 | 1.60 |
| Burette support | — | 1 | 1 | 3.75 |
| Burner, Bunsen | — | 2 | 2 | .95 |
| Cork borers, 3/16 to 9/16 in. | — | — | 9 | 1.25 |
| Crucibles, Coors porcelain, 15-ml. | — | 12 | 24 | .17 |
| Crucibles, Gooch, 25-ml. | — | 12 | 24 | .45 |
| Crucible holders, Gooch | — | 2 | 2 | .45 |
| Crucible tongs, 8-in. long | — | 1 | 1 | .40 |
| Desiccator with plate, 6-in. | — | 1 | 1 | 15.00 |
| Drying oven | — | 1 | 1 | 70.00 |
| Evaporating dishes, 85-mm. | — | 6 | 6 | .62 |
| Filter paper for Buchner funnel packs | — | — | 3 | 1.50 |
| Flasks, Erlenmeyer, 500-ml. | — | 2 | 2 | .25 |
| Flasks, flat-bottomed, 1-liter | — | — | 2 | .34 |
| Flasks, volumetric, 250-ml. | — | — | 1 | .60 |
| Flasks, volumetric, 500-ml. | — | 1 | 1 | .70 |
| Flasks, volumetric, 1-liter | — | — | 1 | 1.00 |
| Funnels, glass, short stem, 2-in. | — | 2 | 4 | .24 |
| Funnels, glass, short stem, 5-in. | 1 | 2 | 2 | .48 |
| Funnels, Buchner, 80-mm. | — | — | 2 | 3.10 |
| Glass rods, 6-mm. (ft.) | — | 3 | 3 | .90 |
| Glass tubing, 7-mm. (ft.) | — | 12 | 12 | .40 |
| Graduated cylinders, 50-ml. | — | 2 | 2 | .65 |
| Graduated cylinders, 100-ml. | — | 2 | 2 | .75 |
| Graduated cylinders, 250-ml. | — | 2 | 2 | 1.10 |
| Graduated cylinders, 500-ml. | — | 2 | 2 | 1.50 |
| Graduated cylinders, 1-liter | — | 2 | 2 | 2.20 |
| Hot plate, electric, 9 x 12 in. | — | — | 1 | 3.00 |
| Hydrogen-ion apparatus | 1 | 1 | 1 | 17.50 |
| Imhoff cones, 1-liter | 3 | 4 | 6 | 3.50 |
| Incubator, 20° C | 1 | 1 | 1 | 240.00 |
| Indicator dropping bottles, 50-ml. | — | — | 2 | .35 |
| Nessler tubes, 50-ml. | — | — | 12 | .60 |
| Nessler-tube stand | — | — | 1 | 3.50 |
| Orthotolidin testing set | 1 | 1 | 1 | 20.00 |
| Pipettes, 2-ml. | — | 2 | 3 | .28 |
| Pipettes, 5-ml. | — | 2 | 3 | .28 |
| Pipettes, 10-ml. | — | 2 | 3 | .35 |
| Pipettes, graduated, 1/10, 1-ml. | 2 | 2 | 6 | .45 |
| Pipettes, graduated, 1/100, 1-ml. | — | — | 2 | .45 |
| Pipettes, graduated, 1/10, 5-ml. | — | 2 | 2 | .45 |
| Rings with screw clamp, 3-in. | 1 | 2 | 2 | .21 |
| Ring stand | 1 | 1 | 2 | .90 |
| Rubber tubing, heavy wall, 5-mm. (ft.) | — | 6 | 6 | .15 |
| Rubber stoppers for suction flasks | — | 2 | 4 | .03 |
| Spatulas, 3-in. blade | — | 1 | 1 | .30 |
| Suction flask, 500-ml. | — | 2 | 2 | 4.80 |
| Suction hose, (ft.) | — | 6 | 3 | .25 |
| Suction pump, water | — | 1 | 1 | 40.00 |
| Test tubes, 25- x 200-mm. (each) | — | — | 12 | .06 |
| Test tubes stand | — | — | 1 | 1.80 |
| Thermometer | — | 1 | 2 | 3.00 |
| Triangles, 2-in. long | — | 2 | 2 | .30 |
| Wash bottles, 1-liter | 1 | 1 | 1 | .70 |
| Watch glasses, 2½-in. | — | 2 | 4 | .04 |
| **Total Cost** | **$315.49** | **$638.05** | **$788.74** | |

## A. M. Rawn New Vice-Pres. Am. Soc. Civil Engrs.

**Long-time Editorial Advisor to Water & Sewage Works**

On October 24 A. M. Rawn of Los Angeles was installed as a new vice-president of the Am. Society of Civil Engrs., representing Zone IV of the society.

Mr. Rawn, a past president of the Federation of Sewage Works Associations has been chief engineer and general manager of the Los Angeles County Sanitation Districts since 1941, having been assistant chief of the Districts from 1924 to 1941. He served in the AEF during World War I, and during World War II served as consultant on sewage disposal to the Construction Quartermaster U.S.A., and also headed up the civilian sewage and sanitation branch of the War Production Board. He is currently a member of the Water Pollution Control Board of California and the Water Pollution Advisory Board of the Federal Government.

Mr. Rawn served the A.S.C.E. as Director from 1942 to 1944, was president of the Los Angeles Section in 1938 and president of the Los Angeles Engineering Joint Council in 1940. He has been chairman of several important A.S.C.E. technical committees.

We have considered of high value AM's long-time connection with *Water and Sewage Works*, as an Editorial Associate and Advisor. He was named "Sewage Works Man of the Year" during his outstanding World War II service to the War Production Board at considerable personal sacrifice.

**Mistake vs. Blunder**

Mark Twain is credited with the following difference between making a mistake and making a blunder. For instance, if you walk into a restaurant and walk out with someones silk umbrella instead of your cotton one, that's a *mistake*. But if you pick up someones cotton umbrella and leave your own silk one, that's a *blunder*.

# Underground Water Contamination By Chromium Wastes

## Nassau County, N. Y., Finds Disposal Through Leaching Pits the Cause; Waste Treatment the Correction

*by* HERBERT W. DAVIDS, *Asst. Public Health Engineer, and* MAXIM LIEBER, *Senior Sanitary Chemist, Nassau County Department of Health, Nassau County, New York*

INDUSTRIAL advances made during the last war have created new problems of industrial waste disposal. One such problem was caused by the growing application of chromium compounds for manufacturing purposes, particularly in the aircraft industry. The unorthodox disposal of chromic acid wastes probably has affected many water supplies throughout the country. Nassau County, with its many aircraft plants, is a good example of an area which has been contending with such a problem. It is, therefore, of interest to note how this contaminant was detected and what measures were taken to trace the extent of the chromium contamination of the ground waters of the County. In addition to surveying the treatment facilities now in operation to overcome this problem, our interest in the subject of chromium contamination has extended to the physiological effects of hexavalent chromium and to methods of analyzing waters containing hexavalent and trivalent chromium ions.

### Permissible Limits of Hexavalent Chromium in Drinking Waters

The United States Public Health Service Drinking Water Standards of 1946 states (*Chemical Characteristics*, paragraph 4.21): "The presence of . . . . hexavalent chromium in excess of 0.05 p.p.m., shall constitute grounds for the rejection of the supply." These limits are given in parts per million by weight, and the method of analysis recommended is given (paragraph 4.31): "Salts of barium, hexavalent chromium, heavy metal glucosides, or other substances with deleterious physiological effects shall not be added to the system for water treatment purposes."

From this last statement, it is assumed that hexavalent chromium in drinking water in concentrations in excess of 0.05 p.p.m. would be deleterious psysiologically. However, correspondence with the Service and a search of the literature revealed that this limit is apparently an arbitrary one; it was established mainly as an expediency and is therefore on the safe side.

It is interesting to note that in the earlier (1942) U.S.P.H.S. Drinking Water Standards there appears the even more prohibitive statement: "Salts of barium, *hexavalent chromium*, heavy metal glucosides, or other substances with deleterious physiological effects shall not be allowed in the water supply system." Apparently the occurrence of hexavalent chromium in concentrations up to 0.04 p.p.m. in surface water supplies in various parts of the country, particularly in California, resulted in the establishment of the limit of 0.05 p.p.m.

However, the toxicity of chromic acid derivatives is well known in the field of industrial hygiene, and a safety factor may be well worth while with the presence of such potent compounds in water supplies. The derivatives of chromic acid are decidedly toxic when taken internally, and a number of severe or fatal poisonings have occurred when these compounds were taken internally. Characteristic skin lesions have been commonly found in those trades where chromates or dichromates are used. These consist of ulcers which develop on parts of the skin which come in contact with the dust or solutions of dichromate. The ulcers are known as "chrome sores." In operations where chromic acid derivations are used, perforation of the nasal septum is very common. There is also a form of dermatitis occurring among photographers and blue-print workers regularly exposed to dilute solutions of potassium dichromate.

### Ground Water Pollution by Chromium

The information on ground water contamination by chromium is rather conspicuous by its absence. The July 1947 issue of the "Michigan Water Works News" contained an article about the contamination of the village wells in Douglas, Michigan, by chromates. The wells were located approximately 1000 feet north of the waste pond receiving the chromate waste and it took about three years for the chromates to pass horizontally through 1000 feet of sand to the wells. Concentrations of 10.8 p.p.m. were found in the wells and it was predicted that the water from the wells would not be free from this pollution for at least six years after the pollution entering the ground water was stopped.

### Chromium Valences and Compounds Found in Nature

The technical literature occasionally appears confused with reference to chromium uses and chromium toxicity, owing to the lack of distinction between chromic compounds (trivalent or bivalent) on the one hand and derivatives of chromic acid (hexavalent) on the other. Thus, reference is sometimes made to "chromic salts" when chromic acid derivatives are intended.

Chromium forms four classes of compounds: (1) chromium peroxide, the composition of which is uncertain, and acids derived from it—monoperchromic acid ($HCrO_5$), diperchromic acid ($H_3CrO_7$), etc., (2) chromium trioxide ($CrO_3$) and the corresponding acids derived from it—chromic acid ($H_2CrO_4$), dichromic acid ($H_2Cr_2O_7$), etc., (3) chromic oxide ($Cr_2O_3$) which forms salts of trivalent chromium such as chromic chloride ($CrCl_3$), and (4) chromous oxide ($CrO$) which forms the rather unstable chromous salts—chromous chloride ($CrCl_2$), etc.

When chromic salts are mentioned in the following discussion the reference will be to other than hexavalent compounds, i.e., trivalent or bivalent chromium compounds. Hexavalent chromium compounds will be referred to as such or as chromates or salts of chromic acid.

### Industrial Uses of Chromium Compounds

Derivatives of chromic acid are used in chrome plating, anodizing aluminum, in the manufacture of such products as paper, linoleum, aniline

dyes, chrome yellow paint (lead chromate), explosives, ceramics, colored glass, batteries, rubber tires and in many other industries.

Chromic salts, on the other hand, have but little industrial value. Chrome alum is used to some extent in photography, chromic fluoride is used technically in dyeing and printing cotton and chromic oxide is used in ceramics and in the glass industry.

### Metal Finishing by Anodizing

The chief use of chromium in Nassau County is by aircraft industries in applying the "anodizing" processes. Anodizing is a finish given to aluminum and aluminum alloys to protect them from corrosion and to prepare their surfaces to take paints. An oxide film on the aluminum surface is the protective coating desired; it may be obtained by using a variety of compounds in the anodizing procedure. The commonly used compounds are chromic acid, sulfuric acid, oxalic acid, phosphoric acid, and sulfamic acid. The U.S. Army and Navy specifications require that chromic acid be used on aircraft parts. Difficulties have been encountered in the successful use of sulfuric acid for anodizing; subsequent failures have occurred due to trapped salts which caused corrosion. Chromates on the other hand are known corrosion inhibitors, and any chromate salts remaining on the work would have no corrosive effect.

It is the purpose of the anodizing process to produce finished surfaces on aluminum and aluminum alloys by electrolytic treatment in a solution of chromic acid. The materials required are a mild alkaline cleaner, and chromic acid, technical grade (98%) ($CrO_3$).

The tanks required are: (1) Cleaning Solution, a steel tank in which a solution temperature of 160-180°F. is maintained and which is provided with ventilating equipment for vapor removal. (2) Hot Water Rinse, a wooden or steel tank with facilities for thorough rinsing, in which a solution temperature of 170-200°F. is maintained. (3) Cold Water Rinse, a wooden or steel tank with facilities for thorough rinsing. (4) Anodizing Tank, a lead-lined or steel tank with facilities both for heating and cooling the anodizing solution; heating is necessary to bring the solution up to operating temperature after idle periods; cooling will usually be necessary during the anodizing operation. This tank requires a temperature of 95°F. (plus or minus five degrees) and is provided with ventilating equipment for fume removal. (5) Cold Water Rinse, a wooden or steel tank with facilities for thorough rinsing with flowing water. (6) Hot Water Rinse, a wood or steel tank with provisions for maintaining a solution temperature of 180-200°F., and with facilities for thorough rinsing.

The electrical equipment required for the above tanks is a direct current generator or rectifier, provided with controls to permit a regulation of 10-40V (plus or minus one volt) at sufficient amperage to supply a current density range of 12-18 amp. per sq. ft. of cathode surface. Preparation of solutions: (1) Cleaning Solution, prepared as per the vendor's instructions, contains from 6 to 12 oz. of material per gallon of water. (2) Anodizing Solution, contains 13.4 oz. of chromium acid per gallon of water.

It should be noted that in anodizing, the work must be made the anode; the cathode in the electrical circuit being the lead or steel tank. In other words, anodizing is the opposite of plating and the chromium ions in the solution are not plated on to the aluminum surface, but they merely remain present in the solution which furnishes the oxygen for the oxide film. Therefore, the chromium used in the anodizing process is not removed in the chemical reaction, except for the small amounts lost on the surface of the metal or entrapped in the work. This "lost" chromium is washed off in the rinsing operations.

Solutions in the anodizing tanks are generally prepared by diluting a 10 per cent chromic acid solution. The chromic acid solutions in these tanks must be continuously renewed in order to keep the solution up to strength and the tanks at the required level. The tanks are dumped at intervals, and the frequency will depend upon the operator, type of work, Army and Navy inspectors, etc. During war time production, the tanks may be dumped as often a severy six months, and an average size plant may use one hundred pounds of chromic acid per day for anodizing. This includes both continuous make-up and new solutions.

The operation and maintenance of the anodizing solution tanks include tests for specific gravity of the solution and pH measurements. The pH will gradually rise from the initial value of 0.5 to above 1.2 as the solution is progressively used for anodizing. The rise in pH is due to aluminum going into solution in the form of dissolved alumina. This "poisoning" of the solution by the dissolved alumina is the usual criteron for the dumping of the tanks; in general, when the pH reaches from 1.2 to 1.5 the tanks are dumped, either completely or only partially and fresh $CrO_3$ is added.

### Ground Water Contamination By Anodizing Wastes

Based on the consumption of 100 pounds of chromic acid a day, the theoretical amount of ground water contamination can be computed. Chromic acid ($CrO_3$) is 52 per cent Cr by weight, therefore waste containing 52 pounds of chromium is

Table 1

LOGS OF CENTRAL PARK WATER DISTRICT WELLS

| Log | Thickness, ft. | Depth, ft. |
|---|---|---|
| *Well No. 1—N746—El. 105—Lauman (July 1940)* | | |
| Gravel, fine and coarse sand | 50 | 50 |
| Sand, Medium gray | 33 | 83 |
| Sand, fine and clay | 40 | 123 |
| Screen—20' of 10" with bottom at 123' | | |
| 20' of 20" | | |
| *Well No. 2—N747—El. 105—Lauman (July 1944)* | | |
| Sand and gravel | 40 | 40 |
| Clay, blue-black | 42 | 82 |
| Sand, | 6 | 88 |
| Sand, coarse | 10 | 98 |
| Clay and fine sand | 8 | 106 |
| Sand, fine and clay | 62 | 168 |
| Sand, fine, shaprt, tan | 25 | 213 |
| Sand, fine, grayish tan, some clay | 14 | 234 |
| Sand, fine, brown and clay | 8 | 242 |
| Screen—40' of 6" with bottom at 232' | | |
| *Well No. 3—N192—El. 105—Layne (May 1944)* | | |
| Sand, coarse and gravel | 41 | 41 |
| Sand, coarse | 64 | 105 |
| Sand, coarse, loose | 42 | 147 |
| Sand, loose | 32 | 179 |
| Sand, muddy | 6 | 185 |
| Sand, coarse, loose | 28 | 213 |
| Clay, tough | 5 | 218 |
| Sand, muddy | 15 | 233 |
| Clay, tough | 14 | 247 |
| Sand, loose | 41 | 288 |
| Sand, muddy | 4 | 292 |
| Sand, loose | 6 | 298 |
| Sand, packed | 22 | 320 |
| Screen 6' of 10" with bottom at 173' (The well was pulled back to 173' due to poor conditions existing at greater depths.) | | |

The above information was obtained by deepening of the well in May, 1944, original log data in G.W. 5 to depth of 179' in September 1937.

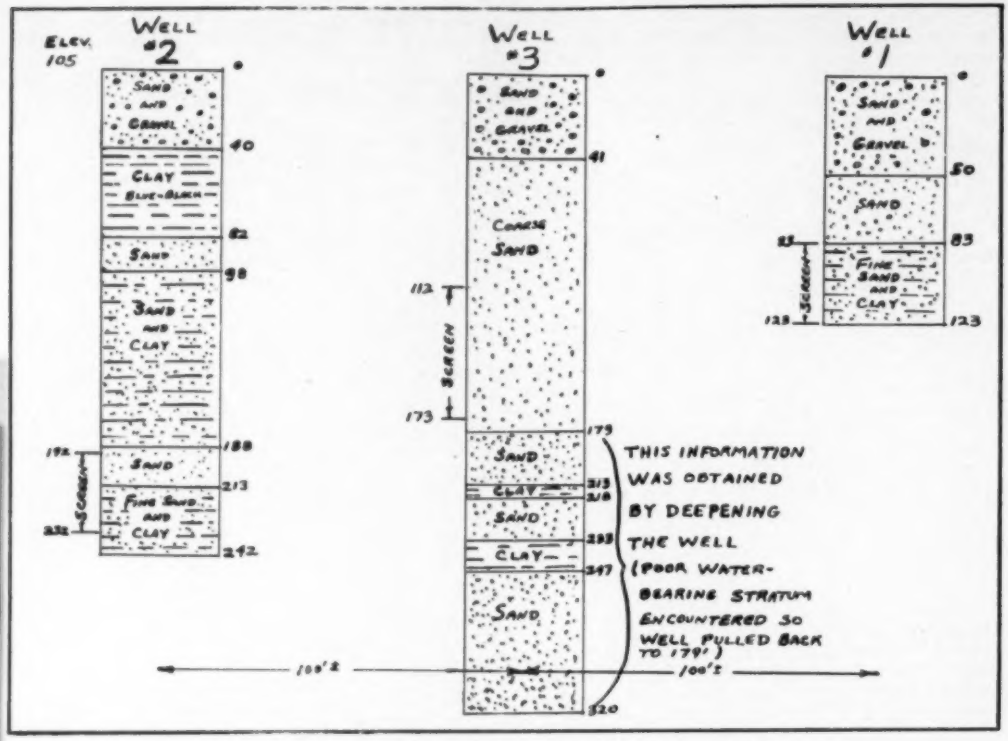



Fig. 1—Geological formations shown by logs of Central Park Water District Wells

discharged to the ground per day. This amount is sufficient to give 52,000,000 lbs. (or 832,000 cubic feet) of water a concentration of 1.0 p.p.m. Cr (20 times the allowable concentration). Assuming the horizontal movement of the ground water to be 4 feet per day, and void space in the soil to be 40 per cent, the width and depth of a strip of water which theoretically could be contaminated to a concentration of 1.0 p.p.m. chromium would be:

$$W \times D = \frac{832{,}000}{4 \times 0.40} = 520{,}000 \text{ sq. ft.}$$

This might be considered to represent a sheet of ground water 5,200 feet wide and 100 feet deep moving in the direction of ground water flow.

### Chromium Contamination in Nassau County, N. Y.

The first reported incidence of chromium in a water supply in Nassau County, N.Y., occurred in June 1942, at the Liberty Aircraft plant in South Farmingdale. During a sanitary survey by the county health department, it was observed that a private well was located relatively close to the pit used for disposal of liquid industrial wastes from the plant. A chemical analysis of the water from this well showed 0.1 p.p.m. chromium. The valence of the chromium was not determined at the time, since there was no standard method for chromium determination in potable water. Authorities at the aircraft plant were advised not to use the well water for drinking purposes, and were also advised to treat their industrial wastes before discharge. Due to war conditions and shortage of field personnel, the situation was not reinvestigated. The well in question was subsequently deepened.

The next indication of ground water pollution by chromium in the county was discovered in July, 1943, at the Grumman Aircraft plant in Bethpage. The plant employees complained of a yellow discoloration in the water flowing from the drinking fountains of the plant. An investigation of the wells serving the plant resulted in the discovery that one well was contaminated with chromic acid. Further investigation uncovered a stoppage in a waste line carrying chromic acid waste. It was found that waste from this line had backed up to a point within 40 feet of the well from which the original complaint originated. It was learned that the gravel packing around this well was higher than that normally acceptable and therefore it was assumed that the chromic acid entered the well by leaking through the joint packing in the stopped waste line. This well was disconnected from the system and pumped continuously to waste. After two weeks of pumping the well was resampled and found to contain 3.5 p.p.m. chromium (valence not determined). This problem was not further investigated.

After the end of World War II, personnel of the County Health Department was increased. We then undertook an investigation of the well supplies in areas south of these aircraft plants as a check on chromium contamination. Difficulty was encountered in obtaining a complete picture of the ground water in these areas, as south of the Liberty plant only a few shallow private wells were in use. South of the Grumman plant, only three public wells and a few widely scattered private wells were in use.

During October, 1947, the County Health Department collected samples of the wells in the area south of the

Grumman plant. All the samples from private wells showed a negative test for hexavalent chromium. However, water from one of the public supply wells, Well No. 3 of the Central Park Water District, was found to contain over 1.0 p.p.m. hexavalent chromium. The use of this well supply was immediately discontinued, and to date it has not been used for water supply purposes because of its hexavalent chromium content.

The text, *Standard Methods for the Examination of Water and Sewage, Ninth Edition,* was followed in the analysis for hexavalent chromium; the diphenylcarbazide reagent employed gives a reddish-violet color with hexavalent chromium. Samples were compared colorimetrically against hexavalent chromium standards. However, the test for total chromium (hexavalent, trivalent and bivalent) is not as simple. The use of perchloric acid, as the recommended oxidizing agent to convert reduced forms of chromium to the hexavalent state, is totally unsatisfactory. Perchloric acid is capable of volatilizing chromium as chromyl chloride both in the absence or presence of chlorides. This procedure is no longer recommended by the U.S.P.H.S. for the determination of total chromium. Comparative studies of new procedures for determining total chromium are now being made by the laboratories of the Nassau County Department of Health, the U.S.P.H.S. and the New York State Department of Health. With a few modifications, our laboratory favors the results obtained with the Sulfuric Acid—Permanganate Method. We have found that the addition of three or four glass beads to the sample, together with frequent shaking of the sample during heating operations, reduces the objectionable effects of bumping. When the chromium content of the sample is high, more than the recommended five minutes is usually required for full color development between hexavalent chromium and the diphenylcarbazide reagent. Using this method of analysis, the Nassau County Division of Laboratories specifies a fifteen minute contact period for maximum color development. The intensity of the color is read on a Brociner-Mass photometer which has been standardized against standard solutions of chromium, utilizing filter No. 520.

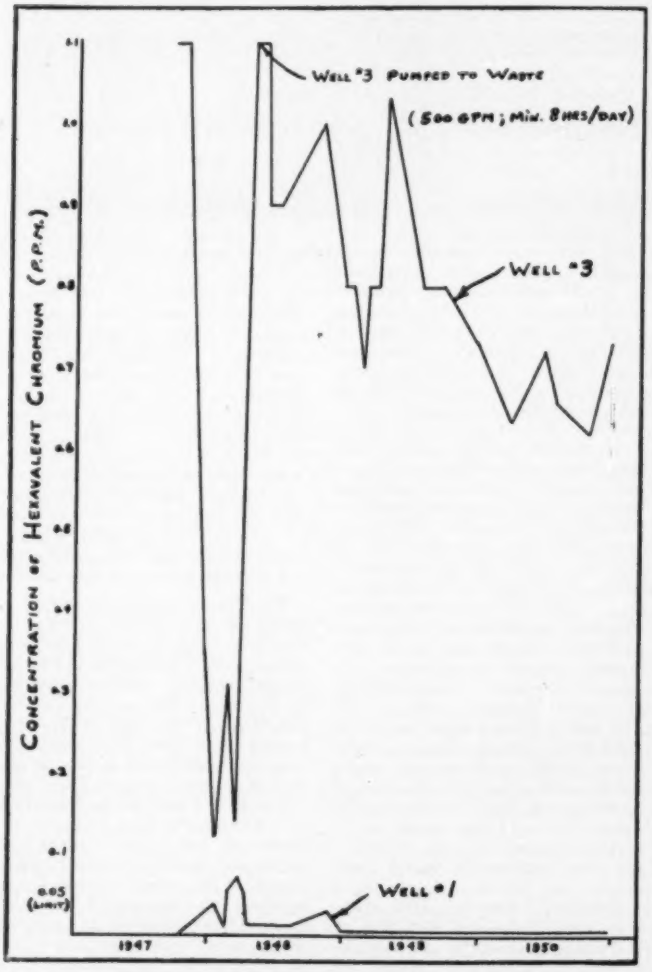



Fig. 2—Relation between pumping of Well No. 3 and reduction of chromium content of water in Well No. 3

### The Sulfuric Acid—Permanganate Oxidation Procedure

The volume of sample used for analysis is dependent upon the chromium content of the water. When the content is low, the determination of total chromium can be made by using a large volume and concentrating to a small volume (by boiling in 1:1 $H_2SO_4$ after the chromium has been reduced to the trivalent state). To the sample add 5.0 ml. of 1:1 $H_2SO_4$ and a slight excess of Sodium Sulfite solution. Allow the sample to stand for several minutes to reduce all hexavalent chromium present to the trivalent state. Evaporate the sample until fumes appear, and fume for five minutes or until clear. During the evaporation and fuming, keep a small funnel in the mouth of the flask to serve as an improvised condenser. Cool the sample and then dilute to approximately 80 ml. with distilled water. Heat to boiling and add $KMnO_4$ solution (0.632 gm. per 100 ml.) drop-wise until a faint pink color appears, then add several drops in excess. Boil the sample for at least ten minutes or until the volume is reduced to 30 or 35 ml. Cool, add 1:1 $NH_4OH$ until a distinct odor of ammonia is detected. Boil gently until the odor of ammonia is faint. The reduced manganese precipitates out and is filtered off. The characteristic color development is produced with diphenylcarbazide reagent as specified in Standard Methods for hexavalent chromium. However, the intensity of the color should be compared after a fifteen minute period of contact between the sample and reagent.

The New York State Department of Health Laboratory confirmed our findings in water from the public well in Bethpage, and found 1.4 p.p.m. hexavalent chromium in Well No. 3 of the Central Park Water District. It is interesting to note that the three wells in this well field, are drilled to varying depths, and are located about 100 feet apart, horizontally. Water samples from the other two wells, one shallower and the other deeper than Well No. 3 were negative for hexavalent chromium in October, 1947. Samples were taken frequently from these two wells, and in December, 1947, a sample from Well No. 1 showed 0.025 p.p.m. hexavalent chromium. Well No. 2 remained negative.

The logs of these wells, Table 1, provides an explanation for this condition. The shallowest well, No. 1, encountered no impervious layers and its screen is set from 103 to 123 feet below grade. The middle depth well, No. 3, which contained the highest concentration of chromium, encountered no impervious layer and its screen is set from 112 to 173 feet below grade. The deepest well, No. 2, which showed no hexavalent chromium contamination, has its screen set from 192 to 232 feet below grade and its log shows a 40 foot thick blue-black clay lens was encountered 40 feet below grade. Also from the 80 foot depth of the screen, a mixture of sand and clay is indicated in the log. Thus, it is apparent that an impervious clay lens separates the hexavalent chromium contaminated stratum from the stratum which furnishes the deepest well, No. 2, with its source of chromium free water. Also it is interesting to note that the screens of wells No. 1 and No. 3 overlap by 11 feet; this can explain why water from Well No. 1 showed a slight hexavalent chromium contamination after Well No. 3 was no longer in use.

The hexavalent chromium content of water from Well No. 1 continued to increase, until a maximum content of 0.07 p.p.m. was reached. At this point it was decided to pump Well No. 3 to waste continuously in an attempt to reduce its hexavalent chromium content. In so doing, the hexavalent chromium in Well No. 3 was slightly reduced (1.4 to 0.9 p.p.m.) but, at the same time, the effect on Well No. 1 was significant. This is illustrated in Fig. 2. The hexavalent chromium content of water in Well No. 1 was reduced to less than 0.01 p.p.m. during this period (about two months). Apparently the continuous pumpage of Well No. 3 influenced the water table so that the hexavalent Chromium bearing stratum was lowered until its level was below the screen of No. 1 Well. The slight reduction in the hexavalent chromium content of water from Well No. 3 may have been due to normal travel of ground water combined with dilution from rainfall, and not primarily due to the continuous pumping of this well.

In the spring of 1945, the Nassau-Suffolk Water Superintendents Conference conducted a forum at which one of the topics considered was that of potential hazards to ground water. The problem of chromium contamination was discussed and, as a result, the New York City Department of Water Supply, Gas and Electricity installed a series of test wells south of the Liberty Aircraft Plant. New York City was concerned with the South Farmingdale area since the city obtains water from the Massapequa Ponds and infiltration gallery. These installations are located due south of Liberty and in direct line of normal ground water travel. The test wells, placed parallel to the flow of ground water, were drilled only to sufficient depth to penetrate the top of the ground water table. We believe no hexavalent chromium was detected in water from the test wells at that time. These wells were resampled by the Nassau County Health Department in April, 1948. Of the six wells sampled, three were found to produce water containing hexavalent chromium. The concentration present ranged from 1.4 to 6.0 p.p.m., the higher concentrations being found in samples from wells closer to the plant.

All known private wells in this area were sampled and, of the 14 wells sampled, water from only one well was found to contain hexavalent chromium (1.0 p.p.m.). The family had used water from the well for about 3 years with no apparent ill effects. Arrangements were made for the members of the family, husband, wife and two children, to have complete physical examinations in a government hospital without charge. The entire family was examined, with results which revealed no abnormalties. The family refused to submit to any further physical examination and continues to use the chromium contaminated water supply. Of course a warning was issued of the possible danger in using this water supply. It was suggested that the family apply for a connection to the public supply main which is located about 100 feet from their property. However, they apparently feel that the additional expense for such a connection is not warranted as they have not experienced any deleterious effects to date. As recently as May, 1951, this water contained 25.0 p.p.m. of hexavalent chromium.

The persistence of this family in continuing the use of the chromium contaminated water, may eventually prove to be a valuable source of information concerning the physiological effects of hexavalent chromium in drinking water. During the original investigations, specimens of urine and feces were collected from one or the members of this family. Attempts were made to analyze these specimens for the presence of chromium. Because of the interfering effect of substances present in these samples on the color reaction between diphenylcarbazide and hexavalent chromium, a spectrographic analysis of the urine and feces samples was attempted. In the spectrogram for this analysis, Figure III, S denotes known specimens of chromium in varying concentrations, F the specimen of feces and U the specimen of urine. The three known persistent chromium lines have wavelengths of 4274.8, 4289.7 and 4254.3 Angstrom Units (A°). On examining the spectrogram of the feces specimen, it is evident that the chromium lines 4254.3 A° and 4274.8 A° are present. It is also possible that the chromium line 4289.7 A° may also be present in the feces spectrogram. (The latter line may be masked by the calcium lines which are present in feces at approximately 4283.0 A°.) We may conclude that there is good evidence indicating the elimination of chromium in the feces of individuals consuming chromium contaminated water. There is also a possibility of chromium being eliminated from the body of such individuals through the urine. However, since the persistent chromium lines are very faint in the spectrogram of the urine specimen, this latter point is not demonstrated in this analysis.

The Nassau County Department of Public Works has drilled approximately 40 wells in the South Farmingdale section in order to bracket the extent of ground water contamination by chromium. The wells were drilled, perpendicular to the direction of ground water flow, to a depth sufficient to establish the extent of contamination in the ground water table, vertically as well as horizontally. The logs of the wells did not indicate any impervious strata until after the chromium contaminated stratum had been passed. The average depth of the impervious clay lens was 72 feet below grade. The depth of the ground water in this area varied from 2 to 14 feet (topography of the South Farmingdale area and the Bethpage area is relatively flat).

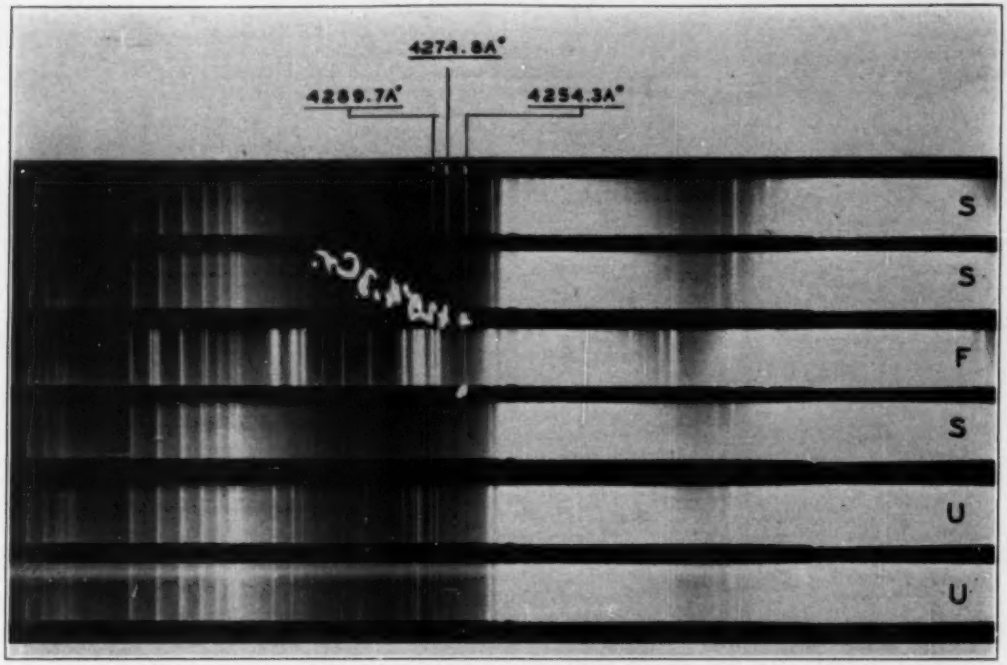



Fig. 3—Spectrogram for chromium analysis. Symbols are: S for chromium standards; F for the feces specimen; and U for the urine specimen.

Test wells were drilled near streets and rough graded roads; the remainder of the terrain is not developed and is covered with underbrush, making it inexcessable to the well drilling rig. The hexavalent chromium contaminated stratum was traced for about a mile south of the Liberty Aircraft plant; beyond this point, there were no more accessible roads and further survey was postponed. Concentrations of chromium up to 40 p.p.m. were found in water samples from these test wells.

A similar survey has recently been started in the area south of the Grumman Plant. Problems arising in this area differ from those encountered in the South Farmingdale area. These differences involve the depth to the ground water (approximately 40 feet), and the variation in the geological formations as indicated in Fig. 1.

### Treatment of Chromium Wastes

A meeting in January, 1948, was attended by representatives of the New York State Department of Health, Nassau and Suffolk Health Departments, the aircraft industries in Nassau and Suffolk Counties and other interested parties concerned with the problem of ground water contamination by chromium. It was decided that this pollution should be abated at its source as soon as possible. Preliminary plans for doing so were to be submitted to the State within a month, final plans in 3 months, and the required treatment plants were to be completed in 6 months. Due to lack of experience in the treatment of anodizing waste, the treatment facilities could be designed only after the aircraft industries conducted research studies.

The first chromium waste treatment plant was completed and placed in operation at Grumman Aircraft Plant No. 2 in late 1948. The plant includes four 11,000 gallon wood stave cylindrical treatment tanks, chemical feeding equipment and pumps. Chemical precipitation by the batch method is the process used. Before entering the treatment plant the anodizing rinse water is mixed with the alkaline wash water, and the pH of the mixed influent ranges from 4 to 5. The pH is lowered to about 2 by adding sulfuric acid; sodium bisulphite is then added in excess, and the tank contents are agitated with air. When milk of lime is added to raise the pH to 8 or higher a precipitate of chromic hydroxide forms and is allowed to settle. After settling for a minimum of four hours, the supernatant is drawn off and disposed of in the leaching pits used to return the storm and cooling waters to the ground. The sludge is transferred to a sludge storage tank and is finally disposed of on a sludge dump. Samples of the effluent of this plant have shown almost complete removal of the chromium from the waste waters. A typical result would indicate 0.01 p.p.m. hexavalent chromium and 0.5 p.p.m. total chromium in the effluent. The influent concentration may vary from 20 to 1000 p.p.m. hexavalent chromium, depending on the operation and the amount of concentrated anodizing bath dumped with the rinse waters.

In the fall of 1949, Liberty Aircraft completed its chromium waste treatment plant. The plant includes three 15,000 gallon reinforced concrete tanks and one 8,000 gallon concrete tank, with the necessary chemical feeding and pumping equipment. Chemical precipitation by the batch process is used, but ferrous sulphate is employed as the reducing agent. Milk of lime is used as the precipitating agent, and no acid is required.

The chemical reactions involved in using ferrous sulfate as the reducing agent are:

$$Na_2Cr_2O_7 + 6\ FeSO_4 + 8\ H_2SO_4 = 2\ NaHSO_4 + 3\ Fe_2(SO_4)_3 + Cr_2(SO_4)_3 + 7\ H_2O$$

The chromic salts are readily precipitated as hydroxides by the application of lime to raise the pH above the point required for neutralization of the acid. The typical reaction is:

$$Cr_2(SO_4)_3 + 3\ Ca(OH)_2 = 3\ CaSO_4 + 2\ Cr(OH)_3$$

This past year has seen the completion of a chromium waste treatment plant by the Republic-Ranger Aircraft firm in East Farmingdale, Suffolk County. The treatment plant in Suffolk County is similar to the one at South Farmingdale, in that ferrous sulfate and lime are the chemicals employed.

### Conclusions

The present status of chromium contamination of the ground water in Nassau County is encouraging. All the large consumers of chromic acid in Nassau County and also those in Suffolk County on the eastern border of Nassau County, have treatment facilities for handling hexavalent chromium wastes. The treatment processes are capable of almost completely removing this toxic element before the waste waters are returned to the ground.

The quality of the ground water in the contaminated areas should continually improve, since pollution by haxavalent chromium wastes no longer takes place. The continued dilution of ground water strata which originally received these wastes, by fresh water entering from rainfall and from normal ground water travel, will eventually remove the cromium contamination.

Field studies, to determine the extent of ground water contamination by chromium in the two areas, are to be continued until the polluted area is bracketed both horizontally and vertically. A fifth test well is being drilled at present by the Nassau County Department of Public Works in the area south of the Grumman Aircraft Plant in Bethpage.

It is apparent that further toxicological studies are necessary in order to determine a safe and reasonable limit for hexavalent and total chromium in drinking waters. The cooperative work to find a satisfactory method for determining total chromium is being continued by the three laboratories previously mentioned.

The writers wish to acknowledge the cooperation and assistance provided by Messrs. Willard Sweeney, Fred Welch and Henry Froenthal of the Nassau County Department of Public Works, and by Mr. Fred J. Biele, Sanitary Engineer of Grumman Aircraft Corporation.

### BIBLIOGRAPHY

1. Chromium data from the Nassau County Department of Health
2. Drinking Water Standards, U. S. Public Health Service. 1942
3. Drinking Water Standards, U. S. Public Health Service. 1946
4. Graham, D. W., "Chromium—A Water and Sewage Problem." Jour. Am. Water Works Assn. 35:159, (Feb.) 1943
5. Herda, N., Treatment of Cyanide and Acid Plating Wastes." Sewage Works Jour. 18: 499, (May) 1946
6. Edwards and Nussberger, "Chromate Wastes and Activated Sludge." Sewage Works Jour. 19:598, (July) 1947
7. Barnes, "Treatment Works for Plating Wastes Containing Toxic Metals and Cyanides. Water and Sewage Works, August 1947
8. Wise, W. S., "The Industrial Waste Problem." Sewage Works Jour. 20:96, (Jan.) 1948
9. Akatsuka, K., "Toxicology of Chromium." Jour. Ind. Hygiene, Jan. 1934
10. Reynolds Metals Company, "Finishes for Aluminum." 1946
11. Eldridge, Industrial Waste Treatment Practice
12. Ruchhoft, Moore, Terhoeven, Middleton and Krieger, "Tentative Analytical Methods for Cadmium, Chromium and Cyanide in Water." U. S. Public Health Service, December 1, 1949
13. State of New York, Dept. of Conservation, Water Power and Control Comm., Ground Water Bulletins Numbers 5 and 10.

## Jordan, DeBerard & Baylis Honored by Northwestern University

The October meeting of the Northern Illinois Water Works Institute held in Evanston, Ill., on Oct. 19, was the occasion for the honoring of three outstanding water supply men, Harry E. Jordan, Exec. Secy. of the Am. Water Works Assn.; W. W. DeBerard, City Engineer of Chicago; John R. Baylis, Engr. of Water Purification, City of Chicago. The photograph pictures the three in the order named.

To each was presented a special Certificate of Commendation for Meritorious Service in the field of water supply, and a commemorative Centennial Medallion from Northwestern University (1851-1951). These were presented in the name of Northwestern Technological Institute at a special banquet held in honor of the three recipients.

A technical session preceded the presentation ceremonies in which the following papers were presented:

C. W. Klassen—"A Century of Water Supply in Illinois."

L. R. Howson—"Economics of Water Works Operations."

J. R. Baylis—"One Hundred Years of Filtration."

W. W. DeBerard—"Plans for Chicago's Central District Filtration Plant."

H. E. Jordan—"Water Works Management—Yesterday, Today and Tomorrow."

## An Acknowledgement

To the Editor:

In the September 1951 issue of *Water and Sewage Works*, you printed our article titled "Leak Detection on Subaqueous Raw Water Intake Line."

In this article we failed to properly acknowledge the very fine services of Mr. Ross Swenson, of the Pensylvania Salt Manufacturing Company, here at Wyandotte, Michigan.

Mr. Swenson's contribution to this leak detection involved the designing and fabrication of the conductivity cell that was shown. He made a temporary model and altered it so that it fitted the conditions under which it was to be used in the Detroit River. He also prepared the cell resistance values shown in Table 1.

We sincerely regret this omission, and trust that you will find it convenient to make this acknowledgement in your magazine at the earliest convenience.

Very truly yours,
George Hazey,
Supt. Filtration, Wyandotte, Mich.

**"Chief, You Tell Him Nextime!"**

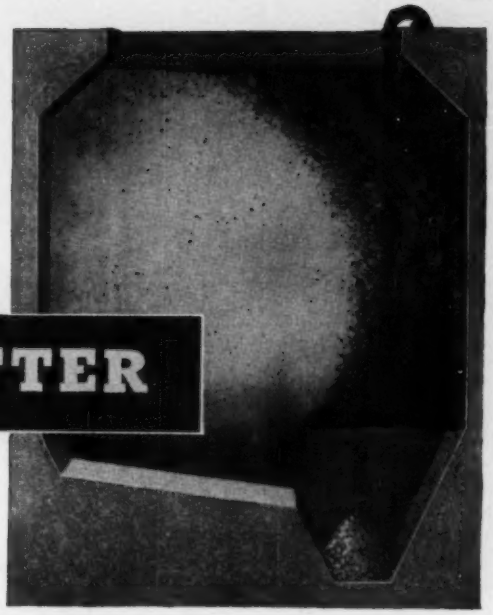
**"Well, didn't you say to tell that Superintendent at Wetmore that evidently he didn't know much about hydrants or he'd be buying ours?"**

# 6

## IMPORTANT BASIC FEATURES

## *Chicago*

# AER-DEGRITTER



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**AIR CONTROLLED VELOCITIES INDEPENDENT OF FLOW**

The Chicago Aer-Degritter provides the only method of removing grit and sand from sewage without movable mechanical equipment. Air introduced through Chicago Swing Diffusers and Precision Diffuser Tubes controls the velocity of the flow. All sand of 0.2 mm. (65 mesh) and larger is washed and deposited in a hopper at the bottom of the tank.

Analysis of grit removed by this system shows less than 10% volatile matter and only a negligible trace of putrescible organics. Because course sewage material will not interfere with the operation of the Aer-Degritter and because it does not affect the hydraulic design of the plant, Aer-Degritters may be installed ahead of all mechanical equipment.

Chicago Aer-Degritters are operating successfully at Oildale, Calif., Columbus, Ohio, Tomah, Wis., Bellaire, Texas and Sedalia, Mo. Aer-Degritters being installed include Fort St. John, B. C., Warsaw, Ind., Elmira, N. Y., Oklahoma City, Okla., Port Washington, N. Y., Anderson, S. C. Design flows of these plants range from .75 to 160.0 MGD.

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**SEWAGE EQUIPMENT DIVISION**

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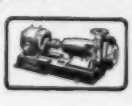
Flush Kleen, Scru-Feller, Plunger, Horizontal and Vertical Non-Clogs Water Seal Pumping Units, Samplers.



Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

CHICAGO SEWAGE EQUIPMENT

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about **DISSOLVED AIR FLOTATION SYSTEMS**

for **SUSPENDED SOLIDS SEPARATION**

Bulkley-Dunton's staff of highly skilled Water Treatment Engineers specializes in developing systems and processes for the separation of

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Many leading industries have availed themselves of this money-saving specialized Engineering Service to:

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- Petroleum production
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- Fruit & vegetable canning
- Automotive industry
- Leather & tanning
- Glue & gelatin manufacture
- Beet & cane sugar refining
- Fish canning
- Wine distilling

It will definitely pay you to investigate Bulkley-Dunton's Water Treatment Engineering Services. Write for details to

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# Meetings Scheduled

Dec. 3-7—Stillwater, Okla. *(Oklahoma A. & M.)*
OKLAHOMA WATER, SEWAGE & INDUSTRIAL WASTES CONFERENCE SHORT SCHOOL, Director, Foster S. Burba, Eng. Bldg., Okla. A. & M. College, Stillwater, Okla.

Dec. 10-14—Stillwater, Okla. *(Oklahoma A. & M.)*
OKLAHOMA WATER, SEWAGE & INDUSTRIAL WASTE CONFERENCE. Sec'y, H. J. Darcey, State Dept. of Health, Oklahoma City 5, Okla.

Dec. 12—Hallowell, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, Winthrop Water District, Winthrop, Me.

Dec. 20—Boston, Mass. *(Hotel Statler)*
NEW ENGLAND WATER WORKS ASSOCIATION. (Monthly meeting). Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Jan. 15, 1952—New York, N.Y. *(Hotel Park Sheraton)*
NEW YORK SECTION A.W.W.A. (Winter Luncheon Meeting) Sec'y, R. K. Blanchard, 50 West 50th Street, New York, N.Y.

Jan. 17 18—New York, N. Y. *(Statler Hotel)*
NEW YORK SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, Ralph C. Sweeney, State Board of Health, 21 No. Broadway, White Plains, N.Y.

Feb. 13-15—Indianapolis, Ind. *(Lincoln Hotel)*
INDIANA SECTION A.W.W.A. Sec'y, Geo. G. Fassnacht, 1330 W. Michigan St., Indianapolis 7, Ind.

Feb. 27-2?—Chicago, Ill. *(Drake Hotel)*
AMERICAN CONCRETE PRESSURE PIPE ASSOCIATION. Mgn. Dir., Howard F. Peckworth, 228 N. LaSalle St., Chicago, Ill.

Feb. 28-Mar. 1—Chicago, Ill. *(Drake Hotel)*
AMERICAN CONCRETE PIPE ASSOCIATION. (44th Annual Convention.) Mgn. Dir., Howard F. Peckworth, 228 N. LaSalle St., Chicago, Ill.

Mar. 9-13—College Station, Texas *(Texas A. & M. College)*
TEXAS WATER & SEWAGE WORKS ASSOCIATION. Sec'y, V. M. Ehlers, 501 West 33rd St., Austin, Texas.

Mar. 24-26—Augusta, Ga. *(Bon Air Hotel)*
SOUTHEASTERN SECTION A.W.W.A. Sec'y, T. A. Kolb, State Board of Health, Wade Hampton Building, Columbia, S.C.

Mar. 26-28—Chicago, Ill. *(Hotel not decided)*
ILLINOIS SECTION A.W.W.A. Sec'y, J. L. Hart, 122 So. Michigan Ave., Chicago 3, Ill.

Apr. 3-5—Mesa, Arizona *(Maricopa Inn)*
ARIZONA SECTION A.W.W.A. Sec'y, H. S. Jordan, State Dept. of Health, Phoenix, Ariz.

Apr. 7-9—Fayetteville, Ark. *(University of Arkansas, Eng. Bldg.)*
ARKANSAS WATER & SEWAGE CONFERENCE. Dr. Harrison Hale, Southern State College, Magnolia, Ark.

Apr. 11-12—Billings, Mont. *(Northern Hotel)*
MONTANA SECTION A.W.W.A. Sec'y, A. W. Clarkson, State Board of Health, Helena, Mont.

Apr. 16-18—Syracuse, N.Y. *(Hotel Syracuse)*
NEW YORK SECTION A.W.W.A. (Spring Meeting). Sec'y, R. K. Blanchard, 50 West 50th St., New York, N.Y.

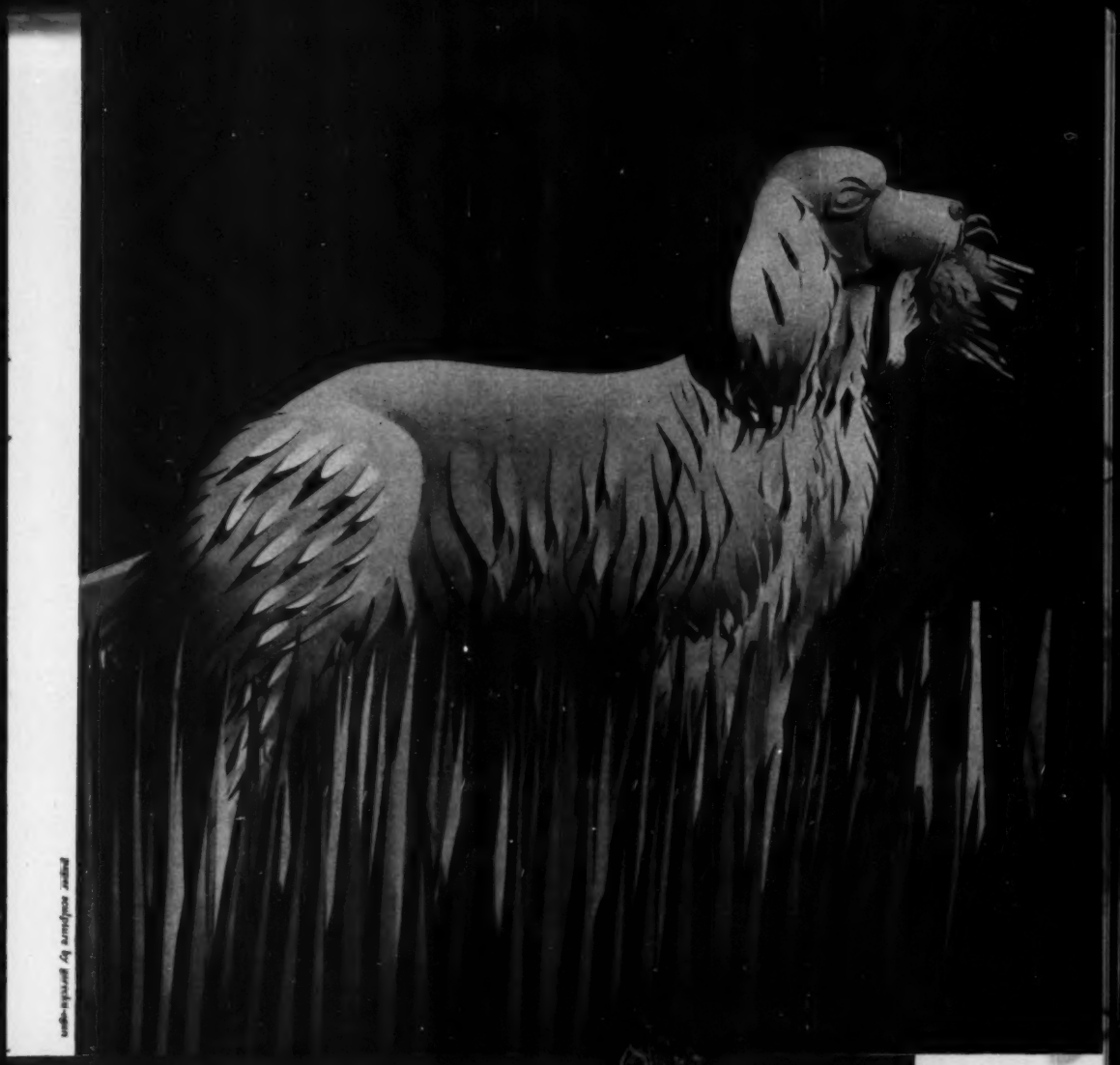
Apr. 17-18—Lincoln, Neb. *(Cornhusker Hotel)*
NEBRASKA SECTION A.W.W.A. Sec'y, E. Bruce Meier, University of Nebraska, Lincoln, Neb.

Apr. 22-26—Spokane, Wash. *(Hotel not decided)*—tentative
PACIFIC NORTHWEST SECTION A.W.W.A. Sec'y, O. P. Newman, Boisie Water Corp., Boisie, Idaho.

May 4-9—Kansas City, Mo. *(Municipal Auditorium)*
AMERICAN WATER WORKS ASSOCIATION (Annual Convention) Exec.-Sec'y, Harry E. Jordan, 521 Fifth Avenue, New York 17, N.Y.
(Accommodations in 14 hotels. Reservations through A.W.W.A. office.)

May 26-28—Montreal, Canada *(Hotel Mt. Royal)*
CANADIAN SECTION A.W.W.A. Sec'y, Dr. A. E. Berry, Ontario Dept. of Health, Parliament Buildings, Toronto, Ont.

June 18-20—Erie, Pa. *(Lawrence Hotel)*
PENNSYLVANIA SECTION A.W.W.A. Sec'y, L. S. Morgan, State Dept. of Health, Greensburg, Pa.

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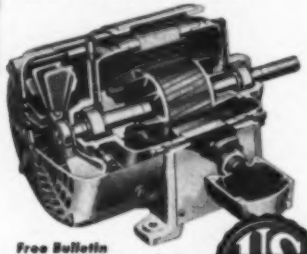

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# Here and There with Doc Symons

**H.T.M.A.**—And as I write this column on Halloween, with the ghosts, the goblins, and the witches hovering over my shoulder here in my attic, it seems like a good time to remind you that any opinion or comment which appears in this column is mine alone, and does not necessarily reflect the attitude or ideas of the editors or management of *Water & Sewage Works*.

I mention the matter because, as some of you know, one of my hobbies is collecting neckties—And I've added a new one to my wardrobe—one of these new ties with writing on it—This one says—"I Like Ike."

* * *

Although I have completed my first full month as an independent consultant and free lance writer I can't get over the number of letters, which are still coming, wishing me well in this new venture.—Thanks again—To everyone.

* * *

I suppose you know, by now, that Harry Faber, longtime Research Chemist of the Chlorine Institute, has resigned that position to take on the job that I gave up last month with *Water & Sewage Works*.—And right here and now, I want to wish Harry well in his new endeavors, which he will undertake on Jan. 1, 1952.

* * *

Speaking of Harry Faber—If you were at the Federation Meeting in St.

(*Continued on page 86A*)


**FOR SALE**

1—24 ton Nichols-Herreshoff Multiple Hearth Burner, used only a few months.

1—30 ton Trash Burner.

For further information, contact Mr. J. R. Palmer, Director of Public Works, City Hall, Rock Island.



WHY BUY MARLOW PUMPS?

ONE IMPORTANT REASON IS —you eliminate many headaches when you standardize on one good line of pumps throughout your system.

Marlow makes the world's most complete line of plunger sludge pumps for sewage disposal works. In four sizes and two types. Any capacity required. There are more Marlow plunger sludge pumps in use than all other makes combined.

Marlow makes the world's most complete line of engine and electric motor driven self-priming centrifugal pumps. From small portables to units of 240,000 GPH capacity.

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Furthermore, Marlow has the largest pump distribution and service organization and Marlow distributors service what they sell.

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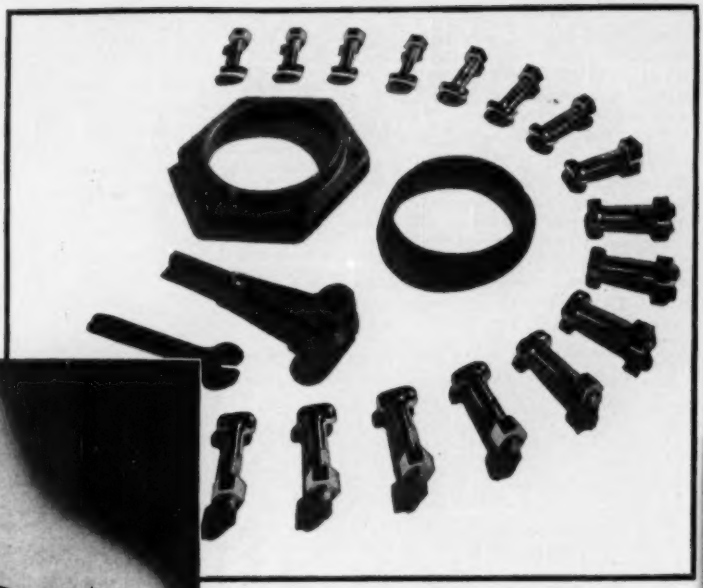
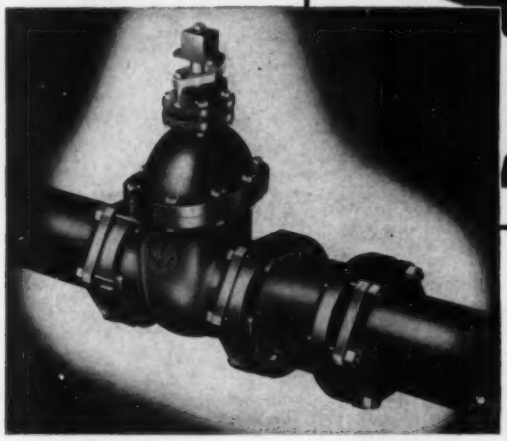
RIDGEWOOD, NEW JERSEY

The Standard of the Industry

# ALL YOU NEED





**IS:** A RATCHET AND OPEN END WRENCH, THREE RUBBER GASKETS, THREE CAST IRON FOLLOWER RINGS AND A HAND FULL OF BOLTS AND NUTS ***TO INSTALL***

# *the New*
# SMITH CUT IN VALVE AND SLEEVE

Gone are the days of—large costly excavations—melting furnaces and pouring pots—pouring and caulking lead joints—when the New All Mechanical Joint Smith Cut In Valve and Sleeve is used.

The Cut In Valve can be installed rapidly, in fair or stormy weather on Cast Iron A.W.W.A. and Federal specification water mains, by unskilled labor, using only two wrenches.

Moulded rubber gaskets fit into machined "Stuffing Box" type joints, guaranteeing a permanent leak-proof seal.

Smith Cut In Valves are manufactured in compliance with the A.W.W.A. Gate Valve specification, and all parts are interchangeable with like parts of Smith A.W.W.A. Gate Valves.

*Write for Bulletin No. MJ2.*

34

FIRE HYDRANTS · VALVES · SINCE 1896

## THE A.P. SMITH MFG. CO.

EAST ORANGE, NEW JERSEY

(*Continued from page 84A*)

Paul early in October, no doubt you saw Sara (Mrs. Harry) and Kelly, their Standard Poodle. "Kelly" is a nickname, because as a puppy, he was such a clown, and what greater clown is there than Emmett Kelly.

One breakfast in St. Paul, Harry was explaining how very appropriate it was for him to have a poodle dog, now that he is associated with *Water & Sewage Works*. You see, the word "poodle" comes from the German word "pudlen" which means "water dog"—He has sewage problems, too, says Harry. Oh yes—Kelly's real name is Pillicock Comprador—Whew!!!!

* * *

And speaking of names—Do you remember my story in the July issue, when I told about Allan Wymore, of K.C. Allan sent an emissary to the AWWA Convention in Miami to kid me about the color of the front cover of the April issue—and when I tried to tell the story, I couldn't remember the name of the man who gave me Allan's message.—Well, his name was —and is—Willbrandt Stukenberg Baum—How COULD I forget?????

AUCTION TODAY
1. What ℅℅ will sell anything from an "old paint" to an old painting?
MID-POINT STATION
2. What ℅℅ will sell anything, anytime for a profit?
3. What ℅℅ sell only quality water treating equipment... for instance the Chlor-O-Mite- a small chemical feeder with big feeder efficiency?
Answer: %PROPORTIONEERS%

No fooling about it, there's a lot of efficiency wrapped up in this little chemical feeder. %Proportioneers% Chlor-O-Mite gives you feeding that's dependable, accurate, adjustable . . . in a new low-capacity feeding range. Its cost is surprisingly low, too, when you consider Chlor-O-Mite's many features: "See-Thru" Reagent Head, Simple Design, Rate Adjustable in Operation, Hydraulic or Electrical Power, Easy Installation.

*Mail coupon or write for complete details*

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Please send Bulletin and price information on the Chlor-O-Mite.
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Answers: 1. Auctioneers 2. Profiteers
3. % PROPORTIONEERS, INC. %


And while I'm thinking about that AWWA Convention in Miami—I never did finish the story of that trip —but come some cold winter day, I shall dwell on the topic again.

I can't leave the Miami story right now, however, before I let you read, over my shoulder, a very interesting letter I received.—

"Dear Doc:—Your description of Key West and your trip to the tip, as it might be called, is written in simple yet vivid words that must charm those who appreciate literary style.

"Why don't you try your hand at fiction that involves descriptive writing such as that of Rex Beach? I met him in the Hotel Washington, in Seattle, 40 years ago and asked:

"'Are you on your way to Alaska to write a sequel to your Silver Horde?'

"'Why, yes. How did you guess it?'

"'Because that story merits a sequel, and your publisher probably demands one.'

"'Quite right as to my publisher, but my bank balance is more insistent. Furthermore as a novelist, I am only a glorified reporter, and a reporter must travel.'

"With best regards, Cordially yours,— H. P. Gillette."

Thanks "H.P." for the kind words. I do hope some day, to do some non-technical writing. If and when I do, one of my stories will be about persons I know who knew famous persons—a sort of second-hand celebrity chasing on my part, as it were.—Of course you and the above story will be in my piece.

* * *

Early in June, I journeyed up to Springfield, Mass., where the NES& IWA and the NYS&IWA were holding their fourth joint convention. I took a couple of pictures that didn't get into the report of that meeting, and inasmuch as I think they're pretty good, I want to show them to you. Now here, for example, is "Johnny" McDonald, Supt. of Sew. Treat.,

Springfield, Mass. and Local Host.—"Johnny" is one of the swellest "guys" you could possibly know—and an expert on Korea, having served there several months at the end of the last war. He can spin some great yarns about sewage treatment—or lack of it —in Seoul, and other spots, now in the news.

* * *

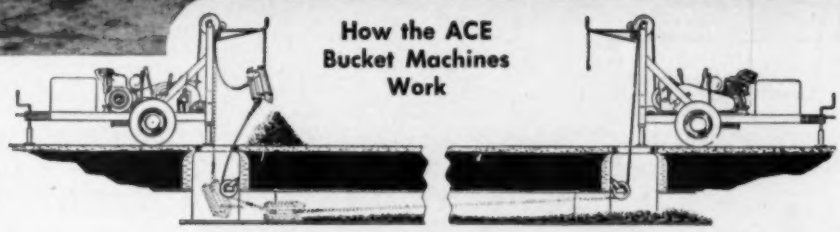
Also at Springfield, I had the good fortune to M.C. one of the forum

(*Continued on page 88A*)

# ACE

## CLEANING JOBS DONE THUS FAR IN 1951:

For Corps of Engineers, U. S. Army; City of Kansas City, Missouri; City of Kansas City, Kansas; Swift & Company; Armour and Company; Cudahy Packing Company; General Motors Corporation; Olathe, Kansas; Belton, Missouri; Milburn Country Club; Council Grove, Kansas; Procter & Gamble Mfg. Co.



How the ACE Bucket Machines Work

ACE

## *Cleans Out* ROOTS, ROCKS and SAND

ACE two-way cleaning operation gets rid of all debris. No half-cleaned sewers here! Toughest roots, heaviest rocks come right out with the rest of the sewage.

Safeguard your city or industry against improper sanitation. ACE *knows* the pipe-cleaning business, sewer, water or culvert! Our rod and bucket operations are quick, sure, and they save you money! Clip and mail the coupon NOW!

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ACE mobile service units go anywhere, any time.

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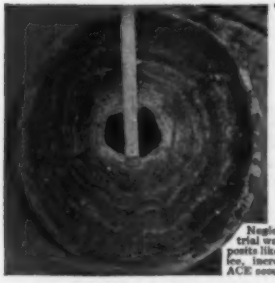


Neglected city and industrial water pipes fill with deposits like this—cut down service, increase fire rates. Let ACE scour them clean for you.

***OK I want to See:***

☐ Your new 21-minute movie of the Kansas City Flood.*
☐ Your Company representative. ☐ More details on your service.

Name_____
Title_____
Company or City_____
Street_____
City and State_____

*Shows 9 minutes of disastrous July, '51 flood, and 12 of aftermath clean-up of flood-clogged sewers, by ACE crews. Taken right on the job!

(Continued from page 86A)

sessions, and of course I took a picture of a couple of the N.Y. State participants. This picture has a trio flavor since all three concerned with its taking are Past Presidents of the NYS&IWA. The two showing are of course, "Eddie" Smith, Supt., Sewage Works, Niagara Falls, and Uhl T. Mann, Supt. Ley Creek Sewage Works, Syracuse.—Uhl's wife, Louise, is that up and coming dress designer who is going to undertake to design some sensible—and cool,—clothes for us poor men for summer wear.

* * *

And it was also at Springfield, where I saw a newspaper clipping that amused me—and I hope will amuse you. From the Norwich, Conn. daily paper came this item.—

"Willis J. Snow, Engineer, Connecticut State Water Commission, Hartford, will appear today before the Norwich Rotary Club and speak on 'Dames and Their Role in Norwich History', bringing out the importance of waterways and their control in the economic development of the community."

Why Willis—Hmmmm!!!!

* * *

One of the smaller, but excellent organizations, to which I belong, is the Westchester Water Works Conference. During the winter months, it meets at regular intervals to discuss topics of interest to water works men; in the summer, it has a picnic or clam bake.—This is the organization that grew out of the Mutual Aid Program and Jim Harding's good work in World War II.—Incidentally, Jim, who is Public Works Commissioner of our great county of Westchester, has this mutual aid program going again under the present Civil Defense Program.

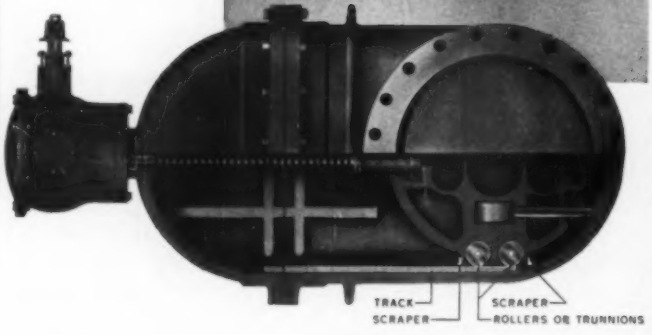
One of the features of the summer shindig of this W.W.W.C. is a main tapping contest for a cup donated by Al Kassay, Supt. of Water & Sewage at Tarrytown, N.Y. At this past summer's session, I took this picture of the contest. Shown here is the winning team from the Town of Thornwood Water Dept.—Ed Fischer and George Fries, who, from a standing start, drilled, tapped, and inserted a corporation cock in a C.I. Main, in the incredible time of 5 min. 30½ sec. —with no leaks!

* * *

Well—what d'ya'know—I didn't get to those State College Meetings or the Boston Meeting of NEWWA—And then there's the Federation and a few other stops—But we'll take those up next month—Right now, let me be the first to wish you a, "Merry Christmas."

**V.T.Y.—Doc.**

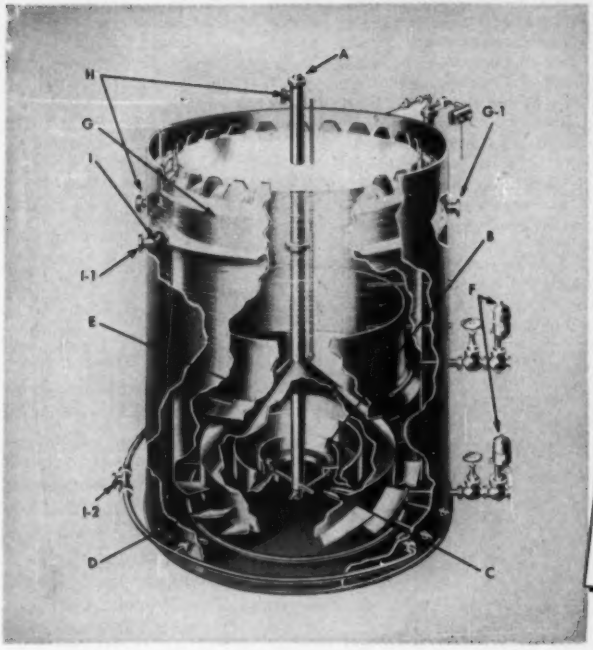

M-H VALVES WITH ROLLERS TRACKS & SCRAPERS




Easy operating

To avoid undue wear of moving parts when installed in horizontal position, large size M & H double disc gate valves may be ordered equipped with rollers or, rollers, tracks and scrapers. This is recommended when large valves are installed on their side and the heavy weight of the gate assembly creates a drag on the underside where it rests on the body. Rollers, tracks and scrapers make the heavy gate assembly easy to open and close, reduces wear and possible damage to the disc rings or the seat rings. For complete information, write or wire M & H Valve and Fittings Company, Anniston, Alabama.

M&H PRODU... Everywhere



Vortex mixing eliminates need for submerged moving parts in the Worthington Cold Process Slurry Type Precipitation Water Softener and Coagulator.

**REACTION TANK** of Worthington Slurry Type Softener (Slurry bed eliminated for clarity). (A) Raw water influent line. (B) Vortexor for optimum slurry production. (C) Chemical Applicators. (D) Slurry bed rotator. (E) Symmetrical Slurry concentrator. (F) Proportionate sludge removal. (G) Collector trough for treated water. (G-1) Treated water effluent. (H) Complementary recirculation. (I) Filter wash water compartment. (I-1) Filter wash water suction. (I-2) Filter wash water return.

# *This slurry bed stays put!*

## *. . . and troublesome variables are out*

**These Features Give You The Uniformity You Want**

**WORTHINGTON SLURRY TYPE PRECIPITATING WATER SOFTENER AND COAGULATOR gives consistent, uniformly softened water**

If it's clear, uniformly softened water you want, this unique Worthington Water Softener is just what you need. Concentrated quick mixing and rapid recirculation of applied chemicals and raw water, *achieved by hydraulic energy instead of submerged mechanical moving parts*, is an important, progressive development in the water treatment field.

New Bulletin W-212-B5 gives you 16 pages of vital facts about this unique cold process water softening method. Write for your free copy today.

**REMEMBER . . .**

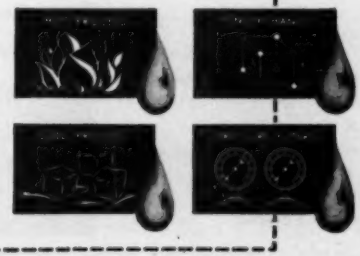
Worthington engineers *all four* water conditioning processes, therefore, can give you unbiased recommendations on which process is right for you . . . further proof that *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Water Treating Division, Harrison, N. J.*

20.1

**WORTHINGTON**

**WATER CONDITIONING**

Worthington Makes More of the Equipment for All Types of Water Conditioning Systems



## Fla. Section AWWA & Fla. Sewage Works Hold Joint Meeting

(*Continued from page 503*)

Next year's convention, discussion indicated, will probably be in Pensacola, combined with the annual meeting of the Alabama-Mississippi Section of the American Water Works Assn. Final decision is to be made by the Board of Trustees.

Possibility of combining the Florida Section with the Florida Sewage and Industrial Wastes Assn., meeting here jointly, will be investigated by a special committee in the coming year. The Sewage and Industrial Wastes Assn., also appointed a committee to study the question.

A tour of the Daytona Beach Water Plant, conducted by Supt. Brennan, and a tour of the Sewage Treatment Plant, conducted by Ralph Metcalf of Russell and Axon, Engineers, concluded the convention.

## Ed. Cleary New President of A.P.W.A.

**Rogers and Officer elected Regional Vice-Presidents; Decher Made Treasurer.**

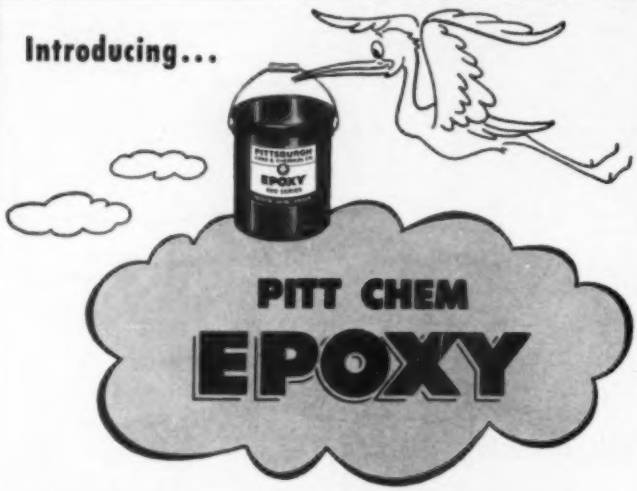
Edward J. Cleary, executive director and chief engineer of the Ohio River Valley Sanitation Commission, Cincinnati, is the new president of the American Public Works Association, succeeding Milton Rosen, commissioner of public works, St. Paul, Minn.

Prior to joining the Ohio River Valley Sanitation Commission, Ed. Cleary was managing editor of *Engineering News-Record*. Currently, he holds the status of consultant to the health and sanitation division of the Institute of Inter-American Affairs as well as to the U. S. Atomic Energy Commission.

Newly-named area vice-presidents of the Association for two-year terms are Allan H. Rogers, superintendent of public works, Garden City, N. Y., for the eastern region; and, Milton Officer, secretary, Board of Public Works, Los Angeles, Cal., for the western area. Holdover vice-presidents for the central and southern areas are George R. Thompson, city engineer, Detroit, and Warren A. Coolidge, director of public works, Nashville, Tenn.

Edward P. Decher, secretary and purchasing agent, Joint Sewer Commission, Newark, N. J., was elected treasurer succeeding Allan Rogers.

J. J. Dean, construction superintendent, Albany, Ga., was named for a two-year post as director of the Association. Re-elected as director was Sol Ellenson, director of public works, Newport News, Va. Continuing members of the board of directors are Ralph C. Graham of Davenport, Ia., and Ralph C. Taylor of Cincinnati, Ohio.

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The new Pitt Chem 600 Series of baked Epoxy Coatings provides you with an improved and specialized weapon for combating industrial corrosion. Effective for many applications involving elevated temperatures, Pitt Chem Epoxy Coatings offer these important advantages:

✓ *Excellent Flexibility*
✓ *Outstanding Alkali Resistance*
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*Send for Additional Information on* PITT CHEM **EPOXY** *Today!*

★ Hot Applied Tar Base Coatings
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GRANT BUILDING - PITTSBURGH 19, PA.

COAL CHEMICALS • AGRICULTURAL CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

# 750,000 pounds of filter cake per day

## converted to fertilizer at new Houston Plant

Another step in Houston's long range plans for complete waste treatment was finished last August with the opening of a C-E Raymond equipped, 28,000 tons per year municipal sewage sludge drying plant.

The two new Flash Drying Units, located at Houston's North Side plant, dry activated-sludge from both the North Side and Sims Bayou plants. Most of the dried sludge is marketed locally for fertilizer but some is shipped as far as the East Coast.

This new plant, designed to serve an equivalent population of 775,000, is equipped with two C-E Raymond Flash Drying Units, each having an evaporation rate of 12,000 pounds per hour.

The Houston Plant is typical of C-E Raymond System installations, now in service in virtually all parts of the country, meeting the varying requirements of both large and small communities. They are flexible in layout, highly efficient and thoroughly reliable; they provide for maximum utilization of waste heat.

The services of C-E specialists are available to assist you in finding the best solution to *your* sludge disposal problem. Get in touch with the office nearest to you for prompt attention.

**Industrial sludges a problem?**

*C-E Raymond Flash Drying and Incineration Systems have been the answer for others. Write for information.*

**Representative list of C-E Raymond installations since 1945**

BALTIMORE, Md.
BETHLEHEM, Pa.
CHICAGO, Ill. (W. Southwest)
FOND DU LAC, Wis.
HOUSTON, Texas
LOS ANGELES, Calif.
SAN DIEGO, Calif. (Extension)
SAN FRANCISCO, Calif.
SCHENECTADY, N. Y.
SHEBOYGAN, Wis.
WATERBURY, Conn.
COLNE VALLEY, England
RECIFE, Brazil
WASHINGTON, D. C.

**COMBUSTION ENGINEERING—SUPERHEATER, INC.**

**FLASH DRYER DIVISION**

1315 North Branch Street, Chicago 22, Illinois

Western Office: 560 W. Sixth, Los Angeles 14, Calif. • Eastern Office: 200 Madison Ave., N.Y. 16, N.Y.

B-490

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT

## Planning Program for Water & Sewage Works Now Totals $561,668,585

When the second Advance Planning Program for non-Federal Public Works was terminated on October 13, 1951 by the Housing Finance Agency, with expiration of its legislative authority, 1,343 projects had been approved to receive assistance in the preparation of plans, engineering studies and drawings to bring them to the building stage. Of this total 719 are for Sewer and Sewage Works and Water Facilities.

The projects approved for Sewer and Sewage Works and Water Facilities are as follows:

| Type | Number | Estimated Cost | Planning Advances |
|---|---|---|---|
| Sewer and Sewage Works | 520 | $378,641,960 | $ 9,301,138 |
| Water Facilities | 199 | 183,026,625 | 3,342,689 |
| Totals | 719 | $561,668,585 | $12,643,827 |

As in the first Advance Planning Program (June 1945-1947) advance planning for sewers and sewage works are far in the lead. They range all the way from the multi-million dollar project of the Allegheny County (Pa.) Sanitary Authority and the Middlesex County (N.J.) trunk sewer proposal to scores of simple collection and treatment systems in small communities. Recent State activities in water pollution control is reflected in many of the applications, practically all of which listed the contemplated construction of treatment or disposal facilities.

Our article in November reported a total of $293,000,000 at that time to be spent for water and sewage facilities in the next few years. The urgency to take advantage of loans for planning and design is indicated in the increase of $268,700,000, which has taken effect since the August report of the H.F.A.

buy with an eye to tomorrow!
People who have switched to BUILDERS Visible Flow CHLORINIZERS are delighted with the performance they get from these chlorine gas feeders. Here are typical comments:
"I haven't had to touch the Chlorinizer for the last six months except to change tanks."
"A glance at the Sightflo indicator shows we're getting the right chlorine feed. With this positive flow rate indicator, Chlorinizers eliminate a lot of guess-work and worry in our plant."
"That chlorine control valve in Builders Chlorinizers is great! I can forget all about it, because I know it's not deteriorating in a bath of corrosive wet chlorine gas."
Chlorinizers are simple, easy to understand. Chlorinizers meter and control chlorine gas in the dry, non-corrosive state. Chlorinizers have a closed chlorine flow line, totally free from stuffing boxes and mechanisms needing frequent attention. Chlorinizers have only one vital control part, the tantalum-diaphragm chlorine valve with its Hastelloy valve pin, silver valve seat, and enameled valve lining.
FOR ANY CAPACITY
FOR ANY CHLORINATION SERVICE
These are the big values you get in Builders Chlorinizers . . . and they're sure to save you maintenance for years to come. Chlorinizers are available in three volumetric models — for any chlorination service:
Up to 400 lbs./day . . . Model DVSX . . . Bulletin 840-I2A
Up to 2000 lbs./day . . . Model CVS . . . Bulletin 840-F1
Up to 6000 lbs./day . . . Model HCVS . . . Bulletin 840-G27
For Bulletins, address Builders-Providence, Inc. (Division of Builders Iron Foundry), 390 Harris Ave., Providence 1, R. I.
BUILDERS PROVIDENCE
Instruments
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BUILDERS

## New Activated Silica Sol for Coagulant Aid

1201

Philadelphia Quartz Co., Philadelphia, Pa., has announced the issuance of a process patent on sterilization and clarification of raw water. U. S. Patent No. 2,567,285 was granted recently to Harold R. Hay and assigned to the Philadelphia Quartz Company.

The patent covers the company's process for preparing an activated silica sol as a coagulant aid. Chlorine is the acid reactant for neutralizing the alkalinity in N[R] Silicate of Soda. The activated silica sol is used in conjunction with a coagulant such as alum, ferric salts or lime to increase speed of floc formation, floc size, density and strength for greater removal of impurities from raw water. Result is clear water and longer filter runs.

Either batch of continuous methods of application may be chosen for the process. The company will grant a license to the user of the process, without royalty fee.

## Michigan Sewage Plant Contract Goes to Welsbach

The Welsbach Corp., Construction Division, Philadelphia, Pa., has been

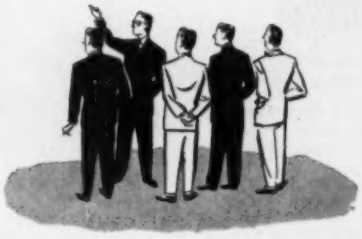
(Continued on page 94A)



If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

# Latest Facts about porous mediums...

**FREE BULLETIN 1246** gives you the most comprehensive coverage of every factor concerned with the selection, installation and cleaning of Norton ALUNDUM* porous plates and tubes for activated sludge plants.



## ...FOR ACTIVATED SLUDGE SEWAGE TREATMENT

Never before has so much vital information about porous mediums been packed in a 20-page bulletin. Here the 35 years' experience of Norton engineers and researchers has been boiled down into easy-to-read form.

### How To Select

Seven pages of charts and data cover every variable that enters into the job of choosing the right porous medium for your plant.

### How To Install

Four pages of drawings, instructions and specifications make it easy for you to superintend correct installation.

### How To Clean

All the causes and cures of clogged plates and tubes are handled in fine detail in four fact-packed pages. Pro's and con's of the various cleaning methods are frankly laid on the table.

### Write for Bulletin 1246

...and get the most interesting, most informative treatise on porous mediums ever published. NORTON COMPANY, 826 New Bond St., Worcester 6, Mass.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

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TRADE MARK REG. U. S. PAT. OFF.

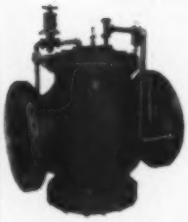
*Making better products to make other products better*

## POROUS MEDIUMS

# PROTECT YOUR WATER SUPPLY
*with*
## ROSS AUTOMATIC VALVES

*EFFICIENT REGULATION OF DISTRIBUTION PRESSURES IS A PROVEN METHOD OF CONSERVATION IN THE FIGHT AGAINST*
DIMINISHING WATER SUPPLIES

**ROSS**
1879



**PRESSURE REDUCING VALVES**
Maintains constant discharge pressure for all changes in rates of flow down stream.

**COMBINATION**
**PRESSURE REDUCING AND BACK-PRESSURE VALVE**

**BACK-PRESSURE VALVE**
Maintains constant upstream pressure regardless of draft down stream.

**OTHER ROSS PRODUCTS**
ALTITUDE VALVES • FLOAT VALVES • RELIEF VALVES
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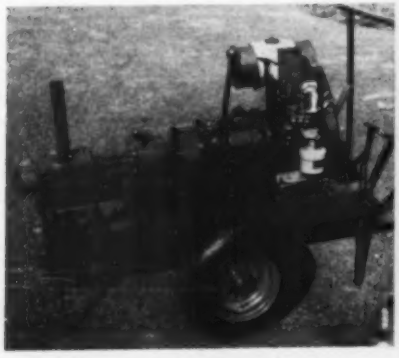
**ROSS VALVE MANUFACTURING CO., INC.**
4 OAKWOOD AVENUE——TROY, NEW YORK





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—
PORTABLE
—
FOR STANDS & UNDERGROUND GATES—MOTOR TRUCK MOUNTED
PAYNE DEAN & CO.
CLINTON, CONN.


(Continued from page 92A)

awarded the contract for the construction of a sewage disposal plant to serve the cities of St. Joseph and Benton Harbor, Michigan.

Mr. Frank R. Harris, who will be in charge of construction said that the $1,750,000 plant will be located on Terminal Island, situated in the St. Joseph River between the twin cities.

When the plant is completed about the end of 1952, it will be of the activated sludge type with separate sludge digestion and sludge filtration of a nominal capacity to provide primary treatment to a flow of 8 M.G.D. and secondary treatment to a flow of 4 M.G.D.

W. R. Leopold David L. Gallagher

## Executives Assigned To Worthington's Public Works Division

Worthington Pump and Machinery Corp., Harrison, N. J., has appointed Mr. W. R. Leopold, Assistant to the Vice President, to direct the operations of the Public Works Division, according to an announcement by Mr. T. Cruthers, Sales Vice President. Mr. D. L. Gallagher has been appointed manager of the division.

Mr. Leopold started with Worthington in 1917 as a sales trainee in the meter shop in Harrison and later that year he was appointed a meter salesman in the New York office. He became successively a meter representative in the Pittsburgh office in 1919, a general line salesman at Pittsburgh in 1928, and assistant sales manager of the Chicago office in 1932. From 1936 to 1945 he was Western manager of the railroad division and for the next five years he was manager of the Detroit office. Last year he was appointed Assistant to Vice President Cruthers.

Mr. Gallagher was graduated from Rensselaer Polytechnic Institute in 1930 with an M. E. degree. After seven years with the New York Power and Light Corporation he joined Worthington as an application engineer in the compressor division of the Buffalo plant. He acted successively as an application engineer in the Reciprocating Pump Division at Har-

(Continued on page 96A)



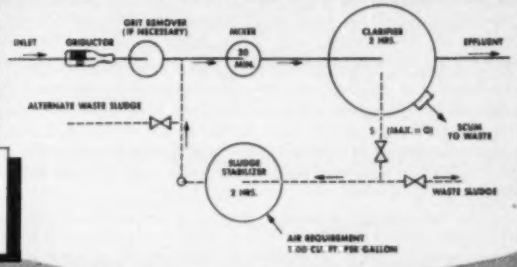
If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

# It's NEW!

# Infilco's Biosorption Process

Write for data on Infilco's new activated sludge treatment method. Ask for Bulletin No. 6550.

**Suggested flow diagram with retention based on average flow of normal strength domestic sewage**




**RESULTS FROM ACTUAL INSTALLATION**

Sewage Treatment Plant, Austin, Texas

| THREE MONTHS TEST PERIOD April May June | ① B.O.D. % Reduction | ② SUSPENDED SOLIDS % Reduction |
|---|---|---|
| Avg. | 93.6 | 93.7 |
| Max. | 98.7 | 97.7 |
| Min. | 89.4 | 90.6 |
| Avg. | 93.6 | 94.0 |
| Max. | 97.7 | 97.5 |
| Min. | 88.0 | 88.9 |
| Avg. | 95.6 | 96.0 |
| Max. | 98.8 | 99.1 |
| Min. | 93.6 | 92.4 |

1 B.O.D. % Reduction

2 SUSPENDED SOLIDS % Reduction

**RETENTION BASED ON AVERAGE FLOW**

| | |
|---|---|
| Mixer | 31 minutes |
| Stabilizer | 2.7 hours |
| Clarifier | 2.4 hours |

3 RETENTION

**AFTER 12-MONTHS TESTING**
in pilot plant studies . . . and now proved by actual installation . . . the Biosorption Process is showing phenomenal results in high-rate biological oxidation sewage treatment.

**IMPORTANT SAVINGS**
in space requirements and initial investment are brought about with total retention time of only about four hours. B.O.D. and suspended solids reductions compare with the optimum obtained by conventional activated sludge treatment methods. Write today for this important test data on the BIOSORPTION PROCESS . . . ask for Bulletin No. 6550.

INFILCO — BETTER WATER CONDITIONING AND WASTE TREATMENT SINCE 1934

**INFILCO INC.** *Tucson, Arizona*

FIELD ENGINEERING OFFICES IN 26 PRINCIPAL CITIES

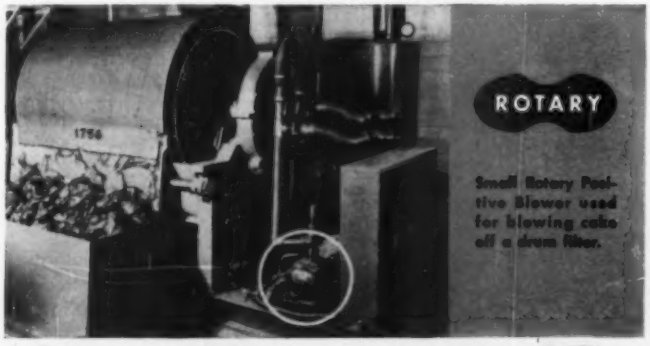
*World's Leading Manufacturers of Water Conditioning and Waste-Treating Equipment*

The superintendent of a large sewage treatment plant made this friendly statement to a Roots-Connersville representative. What he really meant was that R-C Blowers and related equipment perform so satisfactorily and dependably that they seldom need anything more than routine inspection by his own men.

In large and small plants—for metropolitan areas, rural villages or industrial sewage treatment—R-C products uniformly give this kind of reliable operation. They continue to deliver rated capacities, year after year, with a minimum of maintenance—whether a small Rotary Positive Blower of 5 cfm capacity or a Centrifugal unit moving up to 100,000 cfm.

If you are planning a new plant, expansion, or replacements, R-C engineers will work with you to select the equipment best fitted to your needs. Almost a century of experience is at your service.

ROOTS-CONNERSVILLE BLOWER CORPORATION
510 Mount Avenue, Connersville, Indiana




ROOTS-CONNERSVILLE
BLOWER BUILDERS SINCE 1854
ONE OF THE DRESSER INDUSTRIES


(Continued from page 94A)

rison, a sales engineer in the Marine Division and then the Public Works Division. Since 1950 he has been Assistant Manager of the Public Works Division.

## Flexible Size Vault For Large Meters

1202

Art Concrete Works, Pasadena, Calif., has developed a new sectional vault to facilitate housing of large meters. Said to be more practical and less costly than a vault poured on the job, this new vault offers wide flexibility as to dimension, as it is fabricated from standard precast sections available from open stock.

The vault is sectional, horizontally and vertically, and each tier rests in cover seat of the tier below, thus assuring proper alignment. Tiers securely lock together at corners with vertical steel pins. Breakaway webs are molded into each plate and can be knocked out where pipe slots are desired. Side plates are flared at the top to form a cover support and to help anchor meter box at a fixed grade in the soil.

Art Concrete also manufacturers a line of precast concrete meter and valve boxes that are available with interchangeable deep-ribbed cast-iron or concrete covers.

## New Plant For Hellige, Inc.

Hellige, Inc., Long Island City, N.Y., has announced plans for a new plant in Garden City, Long Island, New York.

(Continued on page 98A)



If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

**95%** OF AMERICA'S LARGE CITIES

**85%** OF AMERICA'S MEDIUM CITIES

**70%** OF AMERICA'S SMALL CITIES

*Use* **"FLEXIBLES"** *Exclusively*

Since we started *"getting the men out of the sewer holes"*... eliminating hard digging and unsanitary working conditions 18 years ago..."**FLEXIBLES**" have saved many a man's life and greatly improved both sanitary and sewer pipe protection! You cannot afford to be without "**FLEXIBLES!**"

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***AMERICA'S LARGEST MANUFACTURER OF PIPE CLEANING TOOLS & EQUIPMENT***

THE SILENT WATCHMAN

# DIXIE TANK AND BRIDGE CO.

**3523 LAMAR AVE.** **P. O. BOX 14**
**MEMPHIS 1, TENNESSEE**

***Complete Service for Elevated Water Tanks—***
***Nation Wide Service—33 Years Experience***

**KEEP THE SAFETY FACTOR IN YOUR TANK THE DIXIE WAY**

By welding seams, pits and rivets which gives a riveted tank 15% more Safety Factor than it had when built. No rivets removed, water supply maintained while work is in progress. On completely reconditioned jobs, the painting is guaranteed for five years, repairs guaranteed for ten years, provided the tank is painted every five years by Dixie Tank and Bridge Company. Yearly inspection, making all adjustments, if any, without additional cost.

*Write Us for Free Copy of Publication*

**SOUND PRINCIPLES OF WATER TANK MAINTENANCE and TANK TALK, by W. A. RILEY**

**Dixie's Nation Wide Service Satisfies**

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**THE LARGEST ORGANIZATION OF ITS KIND GIVING SAFE MAINTENANCE AT LOW COST**

a protected installation

A protection case of superior "Sand-Spun" cast iron and protection case cap surround the Mathews removable barrel, which contains all the working parts. These act as insulation against ground heaves—prevent strain on the bottom pipe joint. And if the hydrant is knocked down by a 10 ton truck, 9 times out of 10 the protection case and cap permit substitution of a new barrel without excavation.

MATHEWS
HYDRANTS

Made by R. D. Wood Company

Public Ledger Building, Independence Square
Philadelphia 5, Pa.

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

Mathews Modernized Hydrants offer these advantages

Compression-type valve prevents flooding • Head turns 360° • Replaceable head • Nozzle levels easily raised or lowered without excavating • Nozzle sections easily changed • Operating thread only part to be lubricated • A modern barrel makes an old Mathews good as new • Available with mechanical joint pipe connections

HYDRO-TITE

DEPENDABLE JOINTING COMPOUND

*Seals Bell and Spigot Water Mains*

Economical—Effective

Over 35 Years Of Dependable Performance

HYDRAULIC DEVELOPMENT CORP.

MAIN SALES OFFICE 50 CHURCH ST., N. Y. C.

General offices and works W. Medford Sta., Boston, Mass.


(*Continued from page* 96A)

Dr. P. A. E. Hellige, President, stated that the new plant, now under construction on a 10-acre tract on Stewart Avenue, Garden City, is expected to start operation in February, 1952. Hellige Inc., will continue to operate two plants in Long Island City and Mineola, New York.

## U. S. Pipe Appoints Fla. Rep.

The United States Pipe and Foundry Company, Burlington, N. J., has announced the appointment of Junius Walthall as resident representative for the State of Florida.

Mr. Walthall will make his headquarters at 1040 Sedeeva Street, Clearwater, Florida.

## Porcelain Enameled Staff Gages

1203

Porcelain Enamel Institute, Washington, D.C., has announced the development of a complete line of porcelain enameled steel staff gages for the measurement of water, sewage and other liquids.

Designed so as not to interfere with the flow of liquid, these gages are said to be completely impervious to rust, discoloration and other deterioration, even when used in liquids with high acid content.

The gages are available in a variety of sizes, with ratings of feet, tenths and hundredths of feet for measuring depth, as well as with graduations in cubic feet per second for measuring liquid flow in such applications as weirs and Parshall flumes. The scales are black on a light background for maximum readability. The smooth, glass-like porcelain enamel surface is self-cleaning in many liquids or easily wiped free of silt or similar deposits.

(*Continued on page* 100A)



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WATER & SEWAGE WORKS READER SERVICE

## READER SERVICE CARDS HOW TO USE THEM

**Please fill out a separate coupon for each item on which you desire information. This will greatly facilitate handling.**

**Key number is at head of each new product, item of equipment, catalog or bulletin, described in this issue.**

**Enter key number in box.**

**Please PRINT your name and title, company or department name, and your address**

**NOTE—**

**These cards are to be used only for items described in THIS ISSUE**

**WATER & SEWAGE WORKS**

**Will see that you receive information desired.**

Dependable because they are tough and rugged. Made to withstand the wear and tear of the modern day strain and stress. For generations of incomparable service, only cast iron pipe can qualify. Serving the industry with Super de Lavaud Cast Iron Pipe, centrifugally, in modern lengths.

*General Sales Offices*
**ANNISTON, ALABAMA**

*We invite inquiries to our nearest sales office*

122 So. Michigan Avenue
Chicago 3, Ill.

350 Fifth Avenue
New York 1, New York

**ALABAMA PIPE COMPANY**
**ANNISTON ALABAMA**

**MERIT PROVEN *in* MANY INDUSTRIES**

Aurora Non-Clog Pumps are available in both vertical and horizontal types—and are widely used in industry for handling liquid products, particularly heavy liquids and liquids containing solids. Also used for industrial by-products, semi-solids, wastes, municipal sewage etc. For impressive specifications and design features ask for BULLETIN 121-C.

Type Ku Aurora Vertical Non-Clog Pump. Sizes to 10".

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA Always PUMPS
**AURORA PUMP COMPANY**
668 Loucks Street — Aurora, Illinois

# There's a fortune buried under Main Street!

Every city, town, village where sewer pipe, water or gas lines are laid has buried thousands of dollars in the ground.

It's buried treasure . . . easy to locate but of value *only* if it has the proper crushing, beam, shock and bursting strength properties.

Cast Iron Pipe serves for centuries. Figures prove it . . . so does the pipe itself!

Available in sizes from 2 inches to 84 inches.

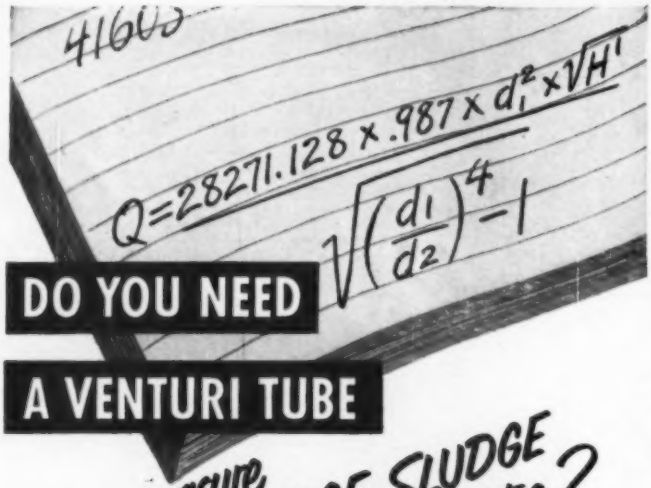
***Send for prices and specifications***

**Warren FOUNDRY & PIPE CORP.**
55 LIBERTY STREET, NEW YORK 5, N. Y.

Bell & Spigot Pipe • Flange Pipe • Mechanical Joint Pipe
Flexible Joint Pipe • Short Body Bell & Spigot Specials

**WARREN PIPE CO. OF MASS. INC. 75 FEDERAL ST. BOSTON, MASS.**

*95 Years of Continuous Service*

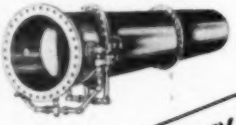



DO YOU NEED A VENTURI TUBE to measure SEWAGE, SLUDGE or TRADE Wastes?

1. A specially designed Venturi Tube for sewage flow with cast-iron upstream section and steel-plate downstream cone.

2. Flat-invert design with long downstream recovery cone for sewage and sludge measurement.

3. Special insert barrel design for sewage flow in restricted locations.



4. Flat-invert and flat top design for sewage flow under low-pressure conditions.

IT'S SIMPLEX IT'S ACCURATE

DIFFERENT forms of Venturi Tubes are available to suit your specific volume and pressure conditions. With these tubes, you can adapt a Simplex Venturi Meter to measure almost any kind of sediment-bearing liquid.

There is a type to suit your needs—whether for sewage, sludge, process liquors, or trade wastes.

Your request for a solution to any measuring problem will bring a prompt reply. Write to Simplex Valve & Meter Company, Dept. 12,6743 Upland Street, Philadelphia 42, Pennsylvania.

SIMPLEX

VALVE AND METER COMPANY


(Continued from page 98A)

It will not absorb permanent stains and is not affected by corrosion.

## Jeffrey Makes Sales Organization Changes

Jeffrey Manufacturing Company, Columbus, Ohio, in a recent announcement by J. A. Jeffrey, Vice President and Manager, Conveyor Division, made the following major changes in the industrial sales organization:

Lincoln Kilbourne, formerly Manager of Sales, Products Engineering Division, becames Manager of Sales, Conveyor Division. C. G. Hawley, District Manager of the Jacksonville office, replaces Kilbourne. L. Cole, Sales Engineer in the Columbus territory, has been named District Manager of the Jacksonville office, replacing Hawley.

Paul Lawall, formerly District Manager of the New York office, returns to the home office in Columbus as Manager of Sales, General Engineering Division. R. W. Sweitzer, District Manager of the Philadelphia office, takes over Lawall's job in New York. W. K. Myers, District Manager in Boston, moves to Philadelphia and will be in charge there. Paul Hendry, who has been working out of the Milwaukee office, becomes District Manager at Boston.

Dan Knies and A. W. Lemmon have been named Consultant Sales Engineers of the Conveyor Division in Columbus.

## Line Locator

1204

Wilkinson Products Company, Pasadena, Calif., has announced the availability of the Wilkinson Line Locator. The locator is said to be an original design, electronically and



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mechanically and the evolution and modern version of the old type "pipe locator."

Indication of locations is by meter and head phones and the unusual transmitter output gives satisfactory performance on the most difficult jobs. The Wilkinson Line Locator can be used for spotting and tracing very small lines, such as No. 8 wire landing field cable installations or for locating large transmission lines buried twenty-five to thirty feet.

This unit can be used both inductively and conductively by separating the transmitter and receiver. All component tubes and batteries are standard stock items.

## J. R. Coffing Elected V. P.

Coffing Hoist Co., Danville, Ill., has announced the election, by its board of directors, of J. R. (Jim) Coffing as Vice President in charge of Sales, Advertising and General Office Administration.

Jim was first associated with the company when at the age of 12 he started in as clean-up boy. He worked his way up through the various departments of production and administration to become General Sales Manager prior to World War II.

Following two and one-half years' service in the U. S. Army Engineers, he resumed his position as General Sales Manager, which post he has held since. Jim attended the University of Alabama, and is a member of the Research and Survey Committee of the American Supply & Machinery Manufacturers Association.

## Link-Belt Opens Factory Branch

Link-Belt Company, Chicago, Ill., announces that it has opened a new Factory Branch Store at 108 South Fourth West Street, Salt Lake City 1, Utah, in order to better serve the mines, mills, and factories in Utah, southern Idaho and eastern Nevada with their power transmission and materials handling machinery requirements.

The new Store and Sales Office is headed by Donald W. Newsome, dis-

"Quit cussing about pipe repairs and replacements -and DO SOMETHING!
install corrosion resistant
SARAN LINED
steel pipe

*Right now* is the time to act! Cut pipe repairs and replacements! Specify corrosion-resistant saran lined steel pipe! You'll find, as have many of the country's leading manufacturers, that this remarkable pipe means dependable long term operation at a minimum maintenance cost. Saran's unusual resistance to most chemicals and solvents plays an important part in the reduction of shutdowns due to pipe repairs and replacements. Another noteworthy advantage is its ease of field fabrication involving NO costly delays with special tools or handling.

These advantages are all important to you, so "quit cussing and do something." For detailed information mail this coupon to the Saran Lined Pipe Co. *Saran lined steel pipe is manufactured by The Dow Chemical Company.*

*Distributed by*

**Saran Lined Pipe Company**

2415 BURDETTE AVE. • FERNDALE, MICHIGAN
With Offices in: New York • Boston • Philadelphia Pittsburgh • Chicago • Tulsa • Portland • Indianapolis San Francisco • Houston • Denver • Seattle • Los Angeles • Cleveland • Charleston, S. C. • Toronto

**send today!**

Please send me a copy of your catalog on Saran Lined Pipe, Valves and Fittings.

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TITLE_____

COMPANY_____

ADDRESS_____

CITY_____

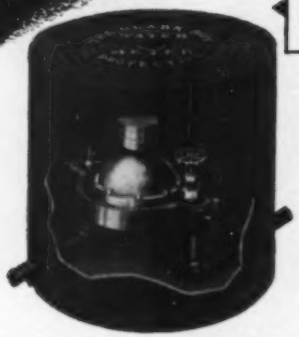
STATE_____

SP-97

SARAN LINED PIPE
DOW
product

CLARK METER BOXES AND COVERS

Left, No. 16 Clark Wonder Lock Meter Box Round....16" and 18" diameters. Large 13" lid.



Above, No. 11 Oval Clark Wonder Lock Meter Box, especially for warmer climates. H-11", L-18", W-12".

Below, A-2-13 Clark Meter Box Cover with screw lock. Height 4", lid opening 13".

Above, A-2-11 Clark Single Lid Meter Box Cover, 4" throat. Also available in 6" and 9" throat.

Below, B-2-11-L Clark Double Lid Meter Box Cover, 6" throat. Also available in 4" and 9" throat.

Above, AA-3-12 Clark Meter Box Cover with 13" Wonder Lock Lid, for use with 15" (illustrated), 18" and 20" box body.

Improved Screw Lock with strong forged bronze bolt.

Wonder Lock Lid (bottom view) showing forged bronze bars.

Perfect Lock of one-piece manganese bronze forging.

write

H. W. CLARK CO.

MATTOON, ILLINOIS


trict manager, an engineer transferred from the Company's San Francisco Plant. He will be assisted by Harry Hotchkiss, who until recently was on the staff of the Link-Belt Store and Warehouse in Spokane, Wash.

## Heavy Duty Metal Primer

1205

Prufcoat Laboratories, Inc., New York, N.Y., has announced the development of Prufcoat Primer P-50 that permits practical field application of both conventional paints and synthetic resin protective coatings to severely corroded metal surfaces.

The primer is composed of a heavy-bodied oil-modified synthetic resin vehicle, carrying a high percentage of inhibitive pigments, principally zinc chromate. The vehicle is such that the pigments are completely free to perform their rust inhibitive function, thus, under-film corrosion is effectively prevented. Prufcoat Primer requires only overnight drying prior to application of active-solvent finish coats.

## Worthington Names Laramy

Worthington Pump and Machinery Corp., Harrison, N.J., has announced the appointment of Mr. J. B. Laramy as Manager of the Marketing Research Department.

Mr. Laramy has been assistant manager of Worthington's Chicago district office for the past six years.

Previously he was graduated from the University of Michigan with a B.S. degree in mechanical engineering in 1929. He then took the Worthington Student Training Course and became an estimator and then a general line salesman in the Chicago district office. In 1945 he was named assistant district office manager at Chicago.

## Brown Insts. Names Sisson

Minneapolis-Honeywell Regulator Co., Brown Instruments Division, Philadelphia, Pa., has named William H. Sisson as power industry manager.

Sisson, now industrial manager of the company's Indianapolis office, will promote product sales in the central



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station and power fields. He will make his headquarters at Philadelphia.

George M. Rossiter is being transferred from the Milwaukee office to Indianapolis where he will become industrial manager succeeding Sisson.

## Precision Speed Control For Magnetic Drives

1206

Electric Machinery Mfg. Co., Minneapolis, Minn., has announced the new E-M Regutron Magnetic Amplifier Control. This new controller is used with the E-M Adjustable-Speed Magnetic Drive, an electromagnetic torque transmitting device which gives variable speed output when used in combination with a constant speed motor.

This simplified magnetic amplifier control eliminates all the complicated electronic circuits of the previous electronic type amplifiers. A simple saturable core reactor amplifier system using non-moving parts accomplishes the precise, stepless control of speed to within 0.5% of speed called for.

E-M Adjustable-Speed Magnetic Drives are built in ratings of 25 horsepower and higher in the usual motor speeds.

## Freemont Adds To Water Treatment Facilities

Welsbach Corporation, Hammond, Ind., signed a contract with Freemont, Ohio for a $700,000.00 addition to the existing water treatment facilities, according to Mayor S. S. Greetham and Safety Service Director Oswin Rauch.

Frank R. Harris, General Superintendent Construction Division, of the


# It's a quick, one-man job to repair a KENNEDY SAFETOP

*Photos taken at N. Y. State Section meeting, A.W.W.A., April 1949*

**IN ONLY 11 MINUTES,** a single man can easily and permanently repair a Kennedy *Safetop* sheared off in a traffic accident. It is the only hydrant with the easily-replaceable, threaded breaking ring that gives positive connection and rigid alignment to the two standpipe sections.

**HIT BY A SMASHING IMPACT,** the *Safetop* breaks cleanly and evenly at the breaking ring. Yet this ring gives a connection strong enough to take as hard a blow as the one-piece hydrant can . . . without damage.

**ONLY A FEW COMMON TOOLS** and inexpensive parts, contained in the *Safetop* Repair Kit, are needed for permanent repair. No digging is required and a compression-type valve prevents flooding or gushing.

**BACK IN SERVICE** after speedy, right-on-the-spot repairs, the Kennedy *Safetop* works as smoothly and efficiently as if nothing had happened. There's no danger of prolonged loss of community fire protection.

**THE COMPLETE KENNEDY LINE**

includes a wide range of A.W.W.A. valves and fire hydrants. When you standardize your community on KENNEDY, you are assured of the same high quality and dependability that have characterized all KENNEDY products for 74 years.

WRITE FOR SAFETOP BULLETIN 105

THE KENNEDY VALVE MFG. CO. • ELMIRA, N.Y.

Est. 1877

VALVES • PIPE FITTINGS • FIRE HYDRANTS

**WILKINSON LINE LOCATOR**

*The original—the pace setter*

Built to QUALITY strict standards

Choice of discriminating buyers everywhere

Buy Satisfaction—not 'first cost'

*Get the facts first*

*Locates all parts of your underground system*

**WILKINSON PRODUCTS CO.**
3987 Chevy Chase Drive
Pasadena 3, California



**THIS IS NEW**

**THE MASTER WATER AND SEWAGE CONTROL TWENTY-FOUR HOUR SERVICE**

*Lightning will strike*
*Accidents will happen*
*MASTER 24 hour service will get you going in a hurry*

A damaged control received by us today is on its way back tomorrow repaired, cleaned and as good as new.

**WE ARE AS NEAR YOU AS YOUR POST OFFICE OR EXPRESS COMPANY**

**HOW DO WE DO IT?**

We have the parts and the equipment. The MASTER demountable construction enables you to easily remove the damaged parts without disturbing the external wiring, conduits or mounting.

The parts most likely to be damaged are light and shipment to us, even by Air Express, is inexpensive and fast.

**FOR YOUR PROTECTION AND THE BEST OF SERVICE**

MASTER guaranteed controls and the MASTER 24 hour service keep the pumps running.

MASTER controls for sewage water and industrial uses.

*Do you have catalog #1050?*

**PIKE HOFFMAN CONTROL CO. Inc.**
273 EAST 5th ST.
ST. PAUL 1, MINN.


Welsbach Corporation, will give the project his personal supervision.

## Rockwell Appoints Vaars Sales Engineer

Rockwell Manufacturing Company, Pittsburgh, Pa., has appointed Mr. H. O. Vaars Sales Engineer. In his present position, he will service water and gas utilities and LP-Gas accounts in Wisconsin and upper Michigan.

Prior to his recent appointment, Mr. Vaars served in a sales capacity with the Perfection Stove Company, Cleveland, Ohio and Pittsburgh Valve and Fittings Corporation, Barberton, Ohio.

## S. Herron New Kennedy Sales Rep.

The Kennedy Valve Mfg. Co., Elmira, New York, has announced the appointment of Shelby Herron, of Houston, Texas, as Sales Representative for the State of Texas.

Before joining the Kennedy organization, Herron was in sales engineering work in the Oil Field Supply business and has also had wide experience in the Machining and Construction fields.

## Vane Type Rotary Pump

1207

Worthington Pump and Machinery Corporation, Harrison, N.J., has announced the addition of a heavy duty, vane type rotary pump to the com-


***"Since 1885"***

**Sewage and Garbage Shredders**

Detailed Specifications and suggested Installation Drawings furnished

**GRUENDLER**
**CRUSHER & PULVERIZER CO.**
**ST. LOUIS 6, MO.**



Every bag of

**BOND-O** *Homogenized*

is a bag of perfect jointing compound

BOND-O's exclusive machine blending process brings you the one flawless self-caulking jointing compound. The finest basic materials obtainable are so thoroughly blended by the BOND-O process—that you are assured of absolute uniformity of performance from every bag you buy.

**NORTHROP & COMPANY, INC.**
SPRING VALLEY NEW YORK



**OMEGA**

***THE LAST WORD IN FEEDERS . . .***

**— for alum, lime, soda ash, ferric sulphate, sodium fluoride, carbon, and other water treatment chemicals. For Bulletins and complete information, address Omega Machine Company, (Division of Builders Iron Foundry) 350 Harris Ave., Providence 1, R. I.**

**OMEGA MACHINE COMPANY**




If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

pany's existing line of rotary pumps.

All models are positive displacement, sliding vane type in which the pressure of the liquid being pumped maintains contact of the vanes against the liner.

The pumps are to be manufactured in both internal and external bearing design; the external bearing models being especially suited for non-lubricating liquids such as gasoline and kerosene. The pumps are manufactured with built-in relief valve and can be manufactured in either standard fitted, bronze fitted or in all bronze construction.

## pH And Chlorine Or Bromide Test Kits

1208

Hellige, Inc., Long Island City, New York, has just published a folder introducing the Hellige Twin-Kit for scientific control and maintenance of swimming pool waters through accurate pH and chlorine or bromine determinations.

The outfit consists of twin pocket-sized Comparators with six glass color standards mounted securely in each housing. One Comparator is used for pH, the other for chlorine or bromine determinations. Direct readings are obtained in the simple 3-step procedure and technical knowledge is not needed.

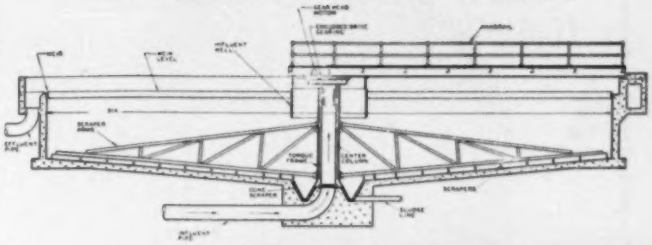
Hellige Non-Fading Glass Color Standards are guaranteed to be permanently reliable and accurate results are assured.

## E. R. English Joins Pipe Protection Svc.

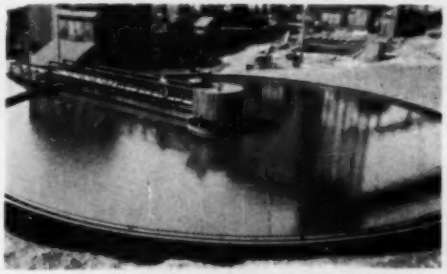
Pipe Protection Service, Inc., Elizabeth, N.J., has announced that E. Rowland English has joined its organization as Vice President. Mr. English will be in charge of sales and will also serve as Assistant General Manager. Pipe Protection operates coating and wrapping plants at Elizabethport, New Jersey, Lowell, Mass. and at customers' job sites.

Mr. English was formerly Eastern Division Manager for H. C. Price Co., Somastic Division. He is a member of the National Association of


# CIRCULAR CLARIFIERS

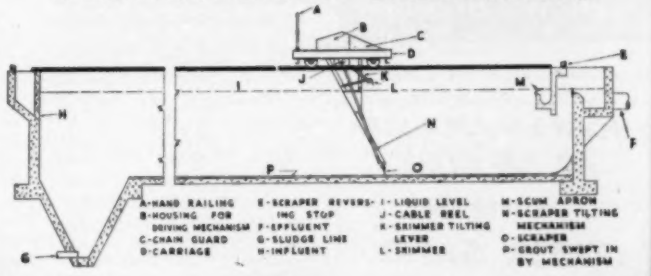


For raw water or waste water treating. Available in sizes up to 200' diameter, either center-column or beam-supported, for steel, concrete, wood or tile tanks. Bulletin 35-C-15.

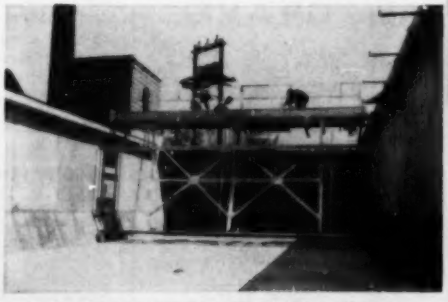


120' Hardinge Circular Unit Handling Coal Breaker Wash Water

# RECTANGULAR CLARIFIERS




In sewage industrial wastes or water treatment plants where space is limited, or where sludge delivery is desired at one end of the tank—the Hardinge Rectangular Clarifier provides a compact, efficient unit. Bulletin 35-C-15.



30' x 100' Hardinge Rectangular Clarifier in Sewage Plant

HARDINGE
COMPANY, INCORPORATED

YORK, PENNSYLVANIA—240 Arch St. Main Office and Works

NEW YORK 17 • SAN FRANCISCO 11 • CHICAGO 6 • HIBBING, MINN. • TORONTO 1
122 E. 42nd St. 24 California St. 205 W. Wacker Dr. 2016 First Ave. 200 Bay St.

a SEAL of CONFIDENCE

GK®
sewer jointing compound

The original and most widely used bituminous sewer joint compound for vitrified tile and concrete sewer pipe

Atlas
MINERAL PRODUCTS COMPANY
MERTZTOWN PA HOUSTON TEXAS

Corrosion Engineers, in which he is an officer of the Northeast Region.

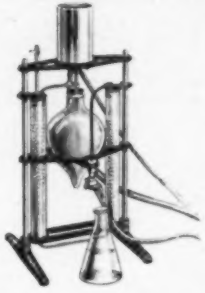
## Spur-Gear Hoist

1209

Coffing Hoist Company, Danville, Ill., has announced the production of the Challenger, a spur-gear hoist incorporating new design innovations, in ½- and 1-ton capacities. The entire unit, including a standard length of high-strength coil chain for an 8 ft. lift, weighs only 39½ lbs.

Strength and unusual resistance to shock-load breakage are said to be gained by the use of formed steel plate in the housing in place of the more common cast aluminum alloy. The back plate is laminated to give extra rigidity for supporting the hoist mechanism. This plate and all other load holding parts are of high-strength steel that will hold five times the rated capacity of the hoist, according to the manufacturer. To further check and confirm its strength, every Challenger is tested at 100 percent overload as it comes off the production line.

ENSLOW
Stability Indicator



For checking the equilibrium of a finished water, and supplying an index useful in controlling anti-corrosion treatment. Catalog No. 83-895

WRITE:

Phipps & Bird, Inc.
P. O. Box 2V Richmond 5, Va.

INSURE YOUR FILTER
AT NO COST
by using our
FILTER SAND and GRAVEL
FOR WATER AND SEWAGE PLANTS

Close attention to detail by experienced men and new modern equipment insure both the quality and prompt shipment of all orders. Our method of shipping in bulk prevents mixing of sizes in transit.

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Try us on your next order.

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A Filter Medium For All Purposes

ANTHRACITE EQUIPMENT CORP.
Anthracite Institute Building
Wilkes-Barre, Pa.

All correspondence regarding sales and engineering should be addressed to:

PALMER FILTER EQUIPMENT CO.
822 E. 8th St. Erie, Pa.
Engineers and Sales Agents

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HEADQUARTERS FOR COLORIMETRIC APPARATUS



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# Literature & Catalogs

## Water & Sewage Laboratory Equipment

1210

Phipps & Bird, Inc., Richmond, Va., has available a catalog on **Modern Equipment For The Water & Sewage Laboratory.**

This up-to-date, 21-page catalog contains a large variety of equipment used by water and sewage laboratories, and each piece of equipment is accompanied by a complete descriptive text. Dimensions, ranges, and operating characteristics are given on all equipment listed. Also included are drawings of most of the equipment listed, along with prices of each item.

A table showing the basic lists of equipment used in outfitting various laboratories broken down as to type of operation for water and sewage plants is included in the back of the catalog.

## Concrete Pressure Pipe

1211

Gifford-Hill-American, Inc., Dallas, Texas., has just published a 30-page booklet on **Concrete Pressure Pipe.**

Amply illustrated with over 70 photographs and drawings the booklet describes how the company is adequately equipped to manufacture four types of Concrete Pressure Pipe in a wide range of sizes and operating pressures up to 300 p.s.i.

Each type of pipe is individually treated in the booklet and tables of wall thicknesses, maximum operating heads, weights and allowable unit stresses are given. Two nomographs for computing the flow of water in concrete pipe are given. These cover the Williams-Hazen and Scobey formulas. A list of installations furnished by the company complete the booklet.


**Civil or Sanitary Engineer** ..... **$5600-$6500**

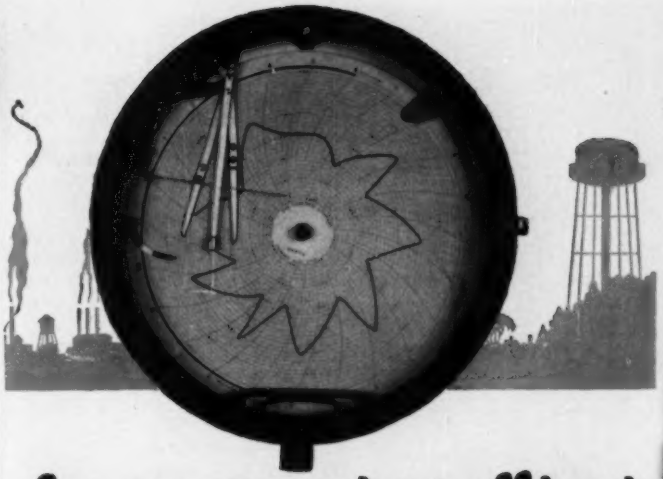
**Civil or Sanitary Engineers** ..... **4500- 5400**

**Construction Engineers—Inspectors** ..... **3000- 4000**

**Engineering Aides 2700- 3600**

**Permanent positions, expanding department in most rapidly growing community in Washington, D.C., Metropolitan Area. Write Office of Sanitary Engineer, County of Fairfax, Fairfax, Virginia, for information and application forms.**





# Can you control cut-off level as close as this?

With Foxboro Recording Rotax Control of water tower altitude, level is automatically and consistently held within limits impossible with pressure switches. A typical municipal installation, for example, employs a tank 30 feet deep, 150 feet above the pump station. With an instrument chart range of 120 feet to 150 feet, the Foxboro Rotax Controller holds the cut-off level to within 6" at all times!

Foxboro Recording Rotax Controllers are set directly to desired cut-off and start-up points, without fussing around or having to measure levels in the tower. Both settings are always readily adjustable by the operator. There's no need for wiring between tower and station because all measurements are made at the pump. And the chart records are constant proof that proper levels were maintained during fires or other emergencies.

Write for new Data sheet containing full installation details and computation nomographs. **The Foxboro Company, 22812 Neponset Ave., Foxboro, Mass., U.S.A.**

*This exclusive Rotax assembly assures positive, unfailing pump operation. Its proven design overcomes disadvantages of ordinary electric controls. Maintenance is virtually eliminated.*

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## Tractor-Shovels

1212

Frank G. Hough Company, Libertyville, Ill., has just made available a new catalog on the **Hough Payloader, Model HY.**

Many action views are used showing how this 1¼ cu. yd. capacity machine is serving the construction and public works fields and solving materials handling problems in many industries. Features such as full-reversing transmission, operator visibility and safety, full hydraulic bucket control, power booster steering and unique unit-design, are clearly illustrated as well as important design details and complete specifications.

## Laboratory Glassware

1213

Corning Glass Works, Corning, N. Y., has published a 190-page catalog on **Laboratory Glassware.**

The catalog covers a complete line of laboratory glassware and features "Pyrex" Brand Laboratory Ware; "Vycor" Brand Laboratory Ware; "Pyrex" Brand Fritted Ware; "Pyrex" Brand "Lifetime Red" Low Actinic Ware; "Corning" Brand Alkali Resistant (Boron-Free) Ware; "Pyrex" Brand Pharmaceutical Ware; and "Pyrex" and "Vycor" Brand Tubing and Rod.

Technical data on the different types of glassware, sizes available, ordering instructions and prices complete the catalog.

## Silent Check Valves

1214

Williams Gauge Company, Pittsburgh, Pa., has just published a 4-page bulletin on **Williams-Hager Silent Check Valves,** which are designed to prevent water hammer.

The bulletin states that these valves not only eliminate the noises,

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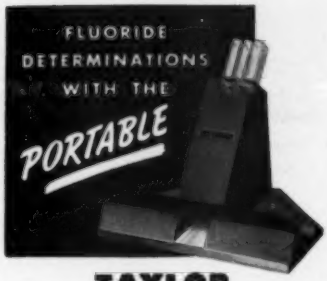


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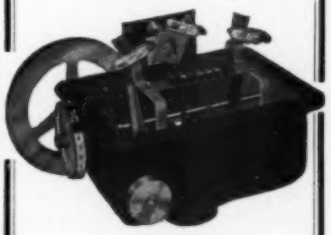

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Technical data, cut-away versions of two types of valves and a series of installation photographs complete the bulletin.

## Long Distance Transmission Of System Variables

1215

Minneapolis-Honeywell Regulator Co., Brown Instruments Division, Philadelphia, Pa., has just published an **Instrumentation Data Sheet** on Long Distance Transmission of System Variables.

The Data Sheet describes the General Electric telemetering systems and their use with Brown ElectroniK recorders in providing ample measurement of system variables plus wire speed transmission of intelligence to central locations. It also describes telemetering requirements, fields of application, basic equipment required and the operation of both frequency torque balance type G.E. telemeters.

Illustration showing the basic layout of the various components of both frequency and balance type of G.E. telemeters with ElectroniK recorders are shown. Typical telemetering combinations are shown diagrammatically.

## Photoelectric Colorimeter

1216

Photovolt Corp., New York City, has announced a new edition of Bulletin 420 on the **Lumetron Photoelectric Colorimeter Model 402-E.**

The bulletin, which has been completely revised and enlarged by the description of a number of recently developed accessories, describes the photoelectric colorimeter, gives its applications, and describes ease of operation and many of its features for the determination of pH, colors and liquids.

## Installing Clay Sewer Pipe

1217

American Society for Testing Materials, Philadelphia, Pa., had just released a pamphlet on **Recommended Practice For Installing Clay**


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**Sewer Pipe.** The material contained in the pamphlet was approved by the Administrative Committee on Standards of the Society on the recommendation of ASTM Committee C-4 on Clay Pipe.

The pamphlet states in the opening paragraph that "the standard is intended to distinguish between proper and improper methods of installing clay sewer pipe in order that the structural properties of such pipe shall be utilized to the fullest advantage."

Discussed in detail are: Strength Classification; Preparation and Examination of Trenches; Preparation of Trench Bottom; Pipe Laying; Backfilling Trenches; and General Recommendations.

## Valve Bulletin

1218

Golden-Anderson Valve Specialty Co., Pittsburgh, Pa., has made available a bulletin covering the line of **G-A Valves.**

The 4-page bulletin describes Golden-Anderson's Triple-Cating Non-Return Valves; Single-Acting (Stop-Check) Non-Return Valves; Throttle and Automatic Engine Stop Valves; Steam Pressure Reducing-Regulating Valves; Automatic Cushioned Controlling Altitude Valves; High Pressure Float Control Valves; Low Pressure Balanced Float Valves; Railroad Water Column Standpipe and Valve; Water Pressure Reducing-Regulating Valves; Water Pressure Surge Suppressor and Relief Valves; Cushioned Swing Check Valve; Cone Thru-Flow Valves; Accumulator Control Valve; Solenoid Electric Water Service Valve, Check Valve, Trip Valve, and Quenching Valve; and Controls and Strainers.

Photographs and cut-away drawings of the valves mentioned above complete the bulletin.


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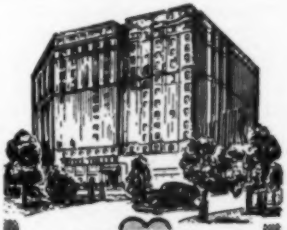

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## Modern Sewer Cleaning Equipment

1219

Expanding Sewer Machine Co., Nappanee, Ind., has just published a new 36 page catalog covering Sewer Cleaning Equipment.

The catalog, amply illustrated with photographs and cut-away drawings, describes the Company's Expanding Root Cutter and Sewer Cleaner that works on an expanding lazy tong principle, putting into play 10 cutting blades of spring steel. Sediment discs for this cleaner are shown and the Junior Expanding Root Cutter and Sewer Cleaner, with sediment discs, is also shown and discussed. The Junior Expanding Root Cutter and Sewer Cleaner is a new machine that has just been added to the company's advanced line of sewer maintenance devices.

Additional equipment, such as Sure Grip Sewer Rods; Arrow Point Leader; Power Sewer Cleaner, with specifications and special features; Windlasses; O.K. Champion Expansion Buckets; Rod Pushers or Pullers; Braces; Augers; "Hydralic" Sewer Flusher; Self Propelling Root Cutters and Nozzles are also described in this complete catalog containing the latest addition to Expanding's line of sewer maintenance equipment.

## Flotation Separator

1220

Sveen-Pedersen Sales Corporation, Long Island City, N. Y., has just released a 4-page bulletin on the **Sveen-Pedersen Flotation Separator.**

The bulletin states that the Separator operates on the principle of forming a supersaturated solution of air in the water to be clarified. The operating principles, advantages, efficiency, operation and construction are discussed in detail. Photographs of an actual installation and the double disc inlet valve illustrate the bulletin. Standard unit sizes from 100 gpm to 2000 gpm are also given.


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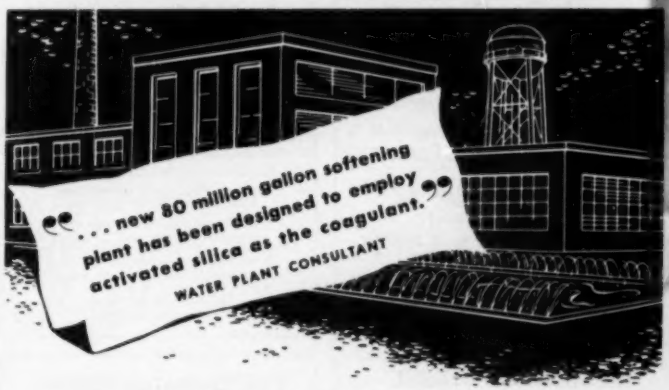
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| | GUARANTEED | ACTUAL |
|---|---|---|
| Capacity—MGD/unit—maximum | 13.33 | 17.5 |
| Turbidity—ppm at maximum flow | 10.0 | Less than 8 |
| —ppm at average flow | 5-10 | ±2 |
| Percent solids in sludge | 30 | 45-48 |
| Power required/unit—KW | 2.0 | 1.74 |
| pH | **10.0 | 9.8-10.2 |
| Alkalinity-Phenolphthalein—ppm | **20.0 | ±1 |
| Methyl Orange—ppm | **40.0 | 23 |
| Total Hardness | **79.0 | 45 |
| Activated silica as reagent—ppm | **4 | 2 |

Stable effluent is being produced by Hydro-Treator without further treatment.

** Estimated at time of bidding.

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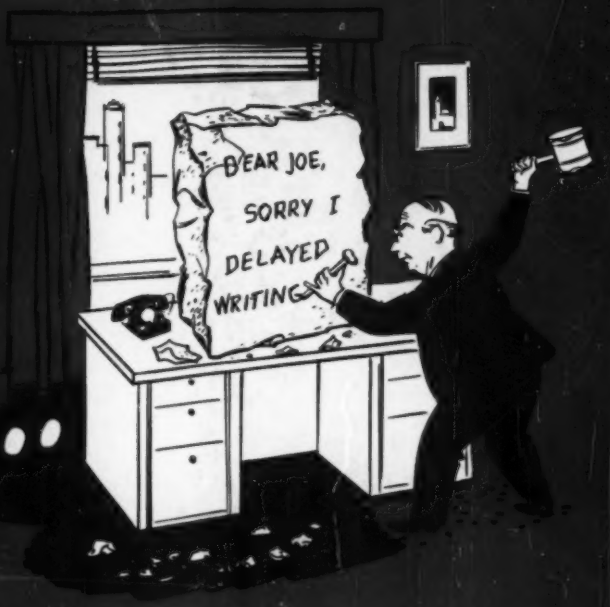


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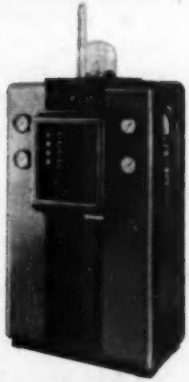

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